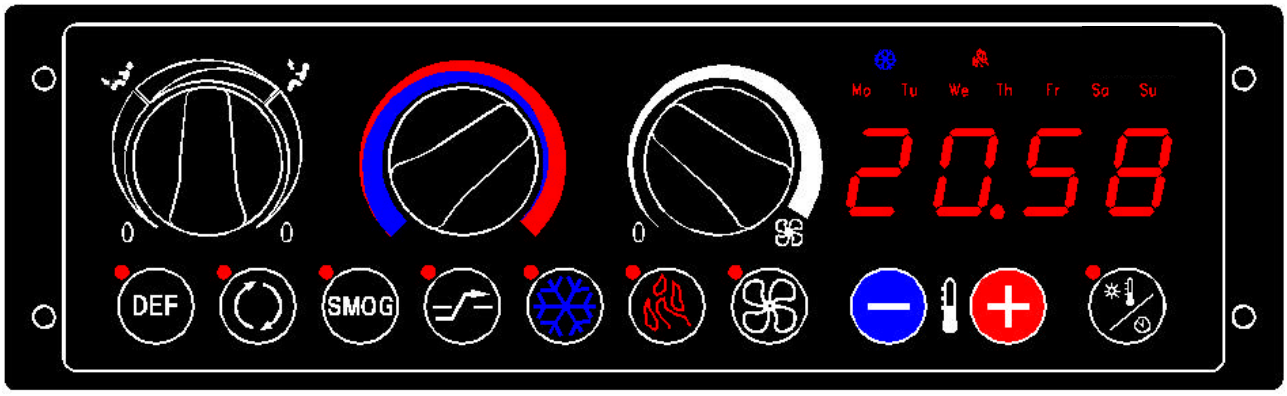
Service manual for climate control system

KR490 - MAN: 88.25935.6482
1362 - MAN: 88.25935.6483
1390 - MAN: 88.25935.6484



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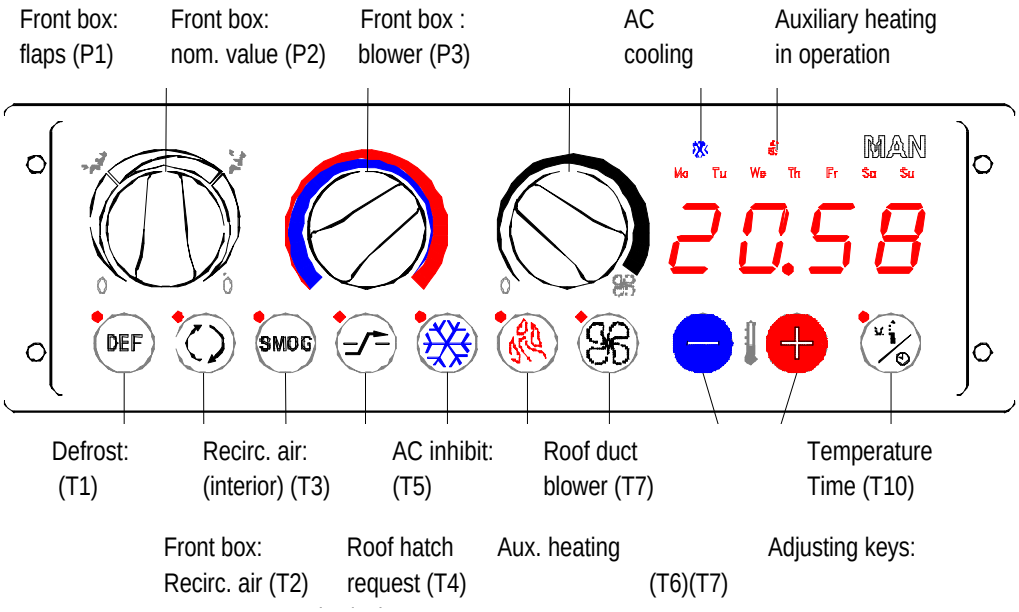
1 User controls



1.1 Standard functions

When the LED corresponding to the button illuminates, this means that the associated function is currently active.

(OFF = Ignition off / ON = Ignition on / ENG = Engine running)

Function	Description	Condition
P1: Front box flaps	Stepless adjustment of air distribution between screen and driver's footwell.	ON, ENG
P2: Front box setpoint blown air temperature	Adjusts the required temperature for the air output between 10° and 80°C. (For cold-water air-con. and ignition on: for Ta < air-con. inhibit temperature - 8K only)	ON, ENG
P3: Front box blower	Adjusts the front box blower. Ignition on: max. 50%. Engine running: max. 100%; Off or 15%: left-hand stop.	ON, ENG
T1: Defrost function	LED on starts the defrost function for clearing the front screen Fresh air flow to screen only, front box blower maximum, front box valve 100% open LED off, flaps, water valve and blower go to settings P1, P2, P3.	ENG
T2: Front box: Recirculated air	Switches the front box recirculated air/fresh air flap LED on = recirculated air	ON, ENG
T3: Air circ. in pass. area	Switches passenger area to recirculated air mode, time-limited LED on = recirculated air	ON, ENG
T4: Roof hatch request	Requests roof hatches to be opened. LED on = flaps open	OFF, ON, ENG
T5: Inhibit air conditioning (AC=Air conditioning)	ON: Shows the number of compressor operating hours on the control unit (value*10 hours). ENG: LED on permits cooling mode; LED off inhibits cooling mode	ON, ENG
T6: Auxiliary heating	LED on switches the auxiliary heating to "ready". The running time is limited to 60 minutes when the ignition is off.	OFF, ON, ENG
T7: Roof channel blower	Switches the passenger compartment blower to a set speed. LED off = Automatic mode; LED on = Manual mode	ON, ENG
T8,T9: Adjustment buttons	Adjusts the required temperature for the passenger compartment. Min. 18°C, max. 28°C, resolution 0.5K	ON, ENG
T10: Temperature / Time	OFF: Set-up mode for clock and 3 programmable switching times for auxiliary heating in conjunction with T8, T9	OFF, ON, ENG

	ON, ENG: Changes over to displaying internal temperature or time for 3 seconds.	

1.2 Additional functions

Special functions, combination functions (buttons pressed simultaneously)			
Function	**Description**	**Display**	**Condition**
T8: Cooling override	Switches to uncontrolled cooling *Initiation:* Release button at min. setpoint then press and hold for more than 2 sec. **Note:** Use only for test purposes. Not when vehicle is in operation.	C	ENG
T9: Heating override	Switches to uncontrolled heating *Initiation:* Release button at max. setpoint then press and hold for more than 2 sec. **Note:** Use only for test purposes. Not when vehicle is in operation.	H	ENG
T4+T10: External temperature	Changes over to displaying external temperature for 3 seconds.	33°	ON, ENG
T1+T10: Test mode	Initiates code request for test mode (Equipment tests, system tests, parameter programming)	CodE	ON
T1+T7: Complete test	Carries out a complete test for checking the connected equipment.	TESt	ON
Externally initiated functions			
Undervoltage	If the supply voltage drops below 22 Volts, the unit switches to undervoltage mode, i.e. all functions and equipment are switched off until the supply voltage rises above 24V once more.	U when button pressed	OFF, ON
Undervoltage (calibration)	If the supply voltage drops below 23.5V during calibration, calibration is stopped until it can be carried out correctly.	_CAL	OFF, ON, ENG
Frost warning (OPTIONAL)	The frost warning is set if the external temperature drops below 3°C. The frost warning is deactivated once more when the external temperature rises above 6°C.	Display on instrument panel	ON, ENG
Last door closing	If there are 24 Volts on the "Last door closing" input, the fresh air flaps in the passenger area are set to rerecirculated air. Normal operation is resumed when the signal switches off.		ENG

1.3 Automatic functions

The automatic climate control is activated when the engine is started. In this case, heating or cooling is initiated as required and depending on the ambient conditions.

When the engine is stopped (ignition on) the control system remains active for a further 10 minutes at reduced roof blower speed, after which it is switched off (with the exception that the auxiliary heating system remains active).

In order to heat the vehicle when the ignition is switched on, the auxiliary heating system must also be switched on. This activates the driver's heating and convector heating to bring the passenger area to the required temperature. In this case, the roof fans remain de-energised.

2 Using the preselector clock

All flashing displays can be adjusted with the "adjustment buttons" (T8) and (T9).

2.1 Displaying time/day of the week

If the "Temperature / Time" button (T10) is pressed twice with the ignition on, the day of the week and the time will appear in the display for 3 seconds.

2.2 Setting the time/day of the week

The current day of the week and the time of day can only be adjusted when the ignition is off. To do this, press the "Temperature / Time" button T10; -CL- (clock) will appear in the display.

When an adjustment button is pressed, the current time will appear flashing and can now be adjusted. The minutes can be adjusted accurately by briefly pressing the adjustment buttons. Holding the adjustment buttons pressed causes the time display to run forwards or backwards. The speed, at which the display changes, increases when the buttons are pressed longer (> 2 sec). **If no buttons are pressed for 5 seconds, the displayed time will be saved** and the day of the week will start to flash.

The day of the week can now be changed using the adjustment buttons.

If no buttons are pressed for 5 seconds, the displayed day of the week will be saved.

2.3 Setting switching times

The three switching times can only be adjusted when the ignition is off. The required switching time is selected by repeatedly pressing the "Temperature / Time" button T10. "–H1–", "–H2–", "–H3–" or "off" will appear in the display. (Auxiliary heating switch-on time 1, 2, 3, off)

When an adjustment button is subsequently pressed, the appropriate switching time will appear flashing and can now be adjusted. The switching time can be set using the adjustment buttons. **If no buttons are pressed for 5 seconds, the displayed time will be saved** and the day of the week will start to flash.

The day of the week can now be changed using the adjustment buttons. In addition to the 7 individual days of the week, all weekdays can also be selected. **If no buttons are pressed for 5 seconds, the displayed day of the week will be saved and the appropriate switching time will be activated.**

When the ignition is off, the LED associated with the auxiliary heating button will flash slowly to indicate that a switching time has been activated.

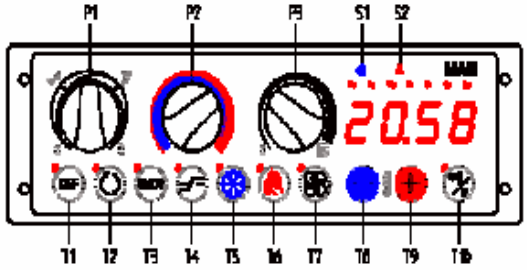
When the ignition is off, the auxiliary heating will switch on at the required time for one hour. If "all weekdays" has not been selected for the day of the week, the activation of the switching time will be cancelled. Otherwise, the auxiliary heating will switch on at the same time on the following day.

2.4 Activating / deactivating switching time

Three switching times can be saved, but only one of them can be active. The switching time last displayed will be activated. All switching times are deactivated when "off" is selected.

Display when pressing T10	Meaning
–CL–	Set time
–H1–	Set/activate switching time 1
–H2–	Set/activate switching time 2
–H3–	Set/activate switching time 3
off	Deactivate switching times

3 Test mode



Initiate test mode with **ignition on** by pressing T1 + T10 simultaneously; "Code" will appear in the display; Enter button code
Customer access: T1, T2, T3; Service access: T1, T2, T2;

Select test programme with T8 or T9;
Start test programme with T10. End test programme with T10.
Exit test mode: T1+T10

Test programmes:

Test number	Description	Customer	Service	TB/Bader
-01-	LED test	x	x	x
-02-	7-segment display test	x	x	x
-03-	Keypad test	x	x	x
-04-	Interrogate software versions	x	x	x
-05-	Valve/flap test	x	x	x
-06-	Analogue input test	x	x	x
-07-	Digital output test	x	x	x
-08-	Digital input test	x	x	x
-09-	Analogue output test	x	x	x
-10-	Set auxiliary heating running time (30/60 min)		x	x
-11-	Valve recalibration		x	x
-13-	Select boarding heater rear / extractor blower		x	x
-18-	Set system parameters			x
-19-	Set EEPROM to default values		x	x
-30-	Set air conditioning inhibit temperature		x	x
-31-	Interrogate/erase fault memory		x	x
-32-	Erase EEPROM			x
-40-	Flap potentiometer P1 adjustment		x	x
-41-	CAN bus test (which nodes are present?)	x	x	x

3.1 Programme -01-: LED test

All LEDs are switched on in turn (17-off)

3.2 Programme -02-: Display test

All segments of the display digits are switched on in turn (4x8-off)

3.3 Programme -03-: Keypad test

(T1+T10 to exit)

The button code for the key concerned is displayed when a button is pressed.

3.4 Programme -04-: Software interrogation

(T10 - next device/ (for KR-490: T1 – Release))

Display	Software of:
LED T1	KR-490 / U1
LED T2	1362 / U2
LED T3	1390 / U3
LED T4	1390 / U4

3.5 Programme -05-: Valve and flap test

(T9 - Open valve / flap; T8 - Close valve / flap; T1 - Next valve / next flap)

Display: "**Number** *Feedback*", e.g. "**7** *56*"

Number	Description	min	max	Pin
1	Front box recirculated air flap (without feedback)			U1 / X3.1,2; X3.3,4,5
2	Front box screen flap			U1 / X3.6,7; X3.8,9,10
3	Front box footwell flap			U1 / X3.11,12; X3.13,14,15
4	Front box driver's valve			U1 / X3.16,17; X3.18,19,20
5	Driver's valve H/C (cold water air conditioning only)			U2 / X3.1,2; X3.3,4,5
6	Mixing valve heating / cooling (cold water air-con. only)			U2 / X3.6,7; X3.8,9,10
7	Mixing valve, roof			U2 / X3.11,12; X3.13,14,15
8	Convector valve			U2 / X3.16,17; X3.18,19,20
9	Not used			U2 / X2.1,2; X2.3,4,5
A	Fresh air flap left			U3 / X2.4,5; X2.6,7,8
b	Fresh air flap right			U4 / X2.4,5; X2.6,7,8

3.6 Programme -06-: Analogue input test

(T9 - Next input; T8 - Previous input; T1 - Display value)

Number	Description	Pin
A 1	External temperature probe	U1 / X1.8,5
A 2	Front box probe	U1 / X2.5, 6
A 3	Potentiometer, front box flaps	U1 (internal)
A 4	Potentiometer, front box temperature	U1 (internal)
A 5	Potentiometer, front box blower	U1 (internal)
A 6	Undervoltage (hex)	U1 (internal)
A 7	Feedback potentiometer, front box recirculated air flap (currently not used)	U1 / X3.4
A 8	Feedback potentiometer, front box screen flap	U1 / X3.9
A 9	Feedback potentiometer, front box footwell flap	U1 / X3.14
A 10	Feedback potentiometer, front box driver's valve	U1 / X3.19
A 11	Potentiometer supply, front box recirculated air flap	U1 / X3.3
A 12	Potentiometer supply, front box screen flap	U1 / X3.8
A 13	Potentiometer supply, front box footwell flap	U1 / X3.13
A 14	Potentiometer supply, front box driver's valve	U1 / X3.18
A 15	Spare probe	U3 / X2.10
A 16	Ice sensor probe (conventional system only)	U3 / X2.13
A 17	Feedback, fresh air flap left	U3 / X2.7
A 18	Potentiometer supply, fresh air flap left	U3 / X2.6
A 19	Supply voltage U3 (hex)	U3 (internal)
A 20	Roof channel probe, right	U4 / X2.10
A 21	Passenger area temperature probe	U4 / X2.13
A 22	Feedback, fresh air flap right	U4 / X2.7
A 23	Potentiometer supply, fresh air flap right	U4 / X2.6
A 24	Supply voltage U4 (hex)	U4 (internal)
A 25	Convector probe	U2 / X1.9
A 26	Spare probe	U2 / X1.14
A 27	Water temperature probe	U2 / X2.7
A 28	Supply voltage U2 (hex)	U2 (internal)
A 29	Feedback potentiometer, driver's motor valve H/C(cold water air conditioning only)	U2 / X3.4
A 30	Potentiometer supply, driver's motor valve H/C	U2 / X3.3
A 31	Feedback potentiometer, motor valve heating / cooling(cold water air conditioning only)	U2 / X3.9
A 32	Potentiometer supply, motor valve heating / cooling	U2 / X3.8
A 33	Feedback potentiometer, roof motor valve	U2 / X3.14
A 34	Potentiometer supply, roof motor valve	U2 / X3.13
A 35	Feedback potentiometer, convector motor valve	U2 / X3.19
A 36	Potentiometer supply, convector motor valve	U2 / X3.18
A 37	Not used	U2 / X2.4
A 38	Not used	U2 / X2.3

3.7 Programme -07-: Digital output test

(T9 - Next output; T8 - Previous output; T1 - Switch output on/off, Output status (LED))

Number	Description		Pin
o 1	Open front box recirculated air flap (recirculated air)		U1 / X3.1
o 2	Close front box recirculated air flap (fresh air)		U1 / X3.2
o 3	Open front box screen flap		U1 / X3.6
o 4	Close front box screen flap		U1 / X3.7
o 5	Open front box footwell flap		U1 / X3.11
o 6	Close front box footwell flap		U1 / X3.12
o 7	Open front box driver's valve		U1 / X3.16
o 8	Close front box driver's valve		U1 / X3.17
o 9	Boarding heater I front	(optional)	U1 / X1.13
o 10	Boarding heater II front	(optional)	U1 / X1.14
o 11	Frost warning		U1 / X1.11
o 12	Request roof hatches		U1 / X1.12
o 13	Side panel heating, front, ON	(cold water air conditioning only)	U1 / X1.15
o 14	Side panel heating, front, Stage 2	(cold water air conditioning only)	U1 / X1.16
o 15	Open fresh air flap left (fresh air)		U3 / X2.4
o 16	Close fresh air flap left (recirculated air)		U3 / X2.5
o 17	Roof blower wake-up left		U3 / X2.12
o 18	Condensers	(conventional system only)	U3 / X2.15
o 19	Open fresh air flap right (fresh air)		U4 / X2.4
o 20	Close fresh air flap right (recirculated air)		U4 / X2.5
o 21	Roof blower wake-up right		U4 / X2.12
o 22	Coolant valve	(conventional system only)	U4 / X2.15
o 23	Heating command		U2 / X2.1
o 24	Not used		U2 / X2.2
o 25	Open motor valve, roof, (open roof circuit)		U2 / X3.11
o 26	Close motor valve, roof, (closed roof circuit)		U2 / X3.12
o 27	Open driver's motor valve H/C	(cold water air conditioning only)	U2 / X3.1
o 28	Close driver's motor valve H/C	(cold water air conditioning only)	U2 / X3.2
o 29	Open convector motor valve		U2 / X3.16
o 30	Close convector motor valve		U2 / X3.17
o 31	Open central motor valve (cooling)	(cold water air conditioning only)	U2 / X3.6
o 32	Close central motor valve (heating)	(cold water air conditioning only)	U2 / X3.7
o 33	Boarding heater I rear		U2 / X1.8
o 34	Boarding heater II rear		U2 / X1.7
o 35	Side panel heater, rear, ON	(cold water air conditioning only)	U2 / X1.5
o 36	Side panel heater, rear, stage 2	(cold water air conditioning only)	U2 / X1.4
o 37	Additional water pump		U2 / X1.10
o 38	Air conditioning coupling		U2 / X1.3
o 39	Auxiliary heating command		U2 / X2.12
o 40	Water pump command		U2 / X2.15

3.8 Programme -08-: Digital input test

(T9 - Next input; T8 - Previous input; T1 - Input status (LED))

Number	Description	Pin
I 1	KL15 Ignition	U1 / X1.3
I 2	D+61 Alternator	U1 / X1.7
I 3	KL58 Lighting	U1 / X1.9
I 4	RM front box blower	U1 / X2.3
I 5	"Last door closing" signal	U1 / X1.10
I 6	Coding 1 left	U3 / X2.3
I 7	Spare input left	U3 / X2.9
I 8	Feedback, evaporator blower module left	U3 / X2.17
I 9	Spare input left	U3 / X2.16
I 10	Feedback, condenser blower module left (conventional system only)	U3 / X2.18
I 11	Coding 2 left	U3 / X2.21
I 12	Coding 1 right	U4 / X2.3
I 13	Spare input right	U4 / X2.9
I 14	Feedback, evaporator blower module right	U4 / X2.17
I 15	Spare input right	U4 / X2.16
I 16	Spare input right	U4 / X2.18
I 17	Coding 2 right	U4 / X2.21
I 18	Feedback, air conditioning pressure switches	U2 / X1.15
I 19	Spare input	U2 / X1.18
I 20	Feedback, auxiliary heating	U2 / X2.11

3.9 Programme -09-: Analogue output test

(T9 - Reduce control voltage; T8 - Increase control voltage; T1 - Next control voltage)

Number	Description	Pin
r1.	Control voltage, front box	U1 / X2.4
r2.	Control voltage, roof blower left	U3 / X2.19
r3.	Control voltage, roof blower right	U4 / X2.19
r4.	Control voltage, spare	U2 / X2.10

3.10 Programme -10-: Auxiliary heating running time

(T1 – toggles between 60 min / 30 min)

Sets the running time for the auxiliary heating with the *ignition off*.

3.11 Programme -11-: Calibrate valves / flaps

(T1 – Starts calibration process)

Starts a recalibration process for the valves and flaps.

3.12 Programme -13-: Select boarding heater rear / extractor blower

(T8 / T9 – Change setting)

Defines whether an extractor blower or a boarding heater is connected at the rear.
Settings: *off* – *AUTO* – *on* (default: *AUTO*)

off – Boarding heater rear
AUTO – Setting dependent on type of bus
(R02/R03 – boarding heater, conventional air conditioning system - extractor blower)
on – Extractor blower

3.13 Programme -18-: Change system parameters

(T9 - Reduce number/value; T8 - Increase number/value; T1 - Toggle between number and value)

See Chapter 5.11

3.14 Programme -19-: Set default values

Starting the programme resets all parameters to the factory settings.

3.15 Programme -30-: Set air conditioning inhibit temperature

(T8 – Reduce value, T9 – Increase value)

Sets the external temperature at which the air conditioning system is inhibited. It is enabled once more at 2K above this temperature. (Default for conventional air conditioning system: *6°C*; Default for cold water air conditioning system: *13°C*)

3.16 Programme -31-: Using the fault memory

(T1 – Delete displayed fault, T8, T9 – Next fault)

Display of the faults in the fault memory. If there are no faults, "OK" will be displayed.

Error number	Fault	Node / Connection
E 3	Short circuit, external probe	U1 / X1.8,5
E 4	Wire break, external probe	U1 / X1.8,5
E 5	Short circuit, passenger area probe	U4 / X2.13,14
E 6	Wire break, passenger area probe	U4 / X2.13,14
E 7	Short circuit, roof channel probe	U4 / X2.10,11
E 8	Wire break, roof channel probe	U4 / X2.10,11
E 9	Short circuit, convector probe	U2 / X1.9,6,11
E 10	Wire break, convector probe	U2 / X1.9,6,11
E 21	Short circuit, front box	U1 / X2.5,6
E 22	Wire break, front box	U1 / X2.5,6
E 23	Short circuit, icing probe (conventional system only)	U3 / X2.13,14
E 24	Wire break, icing probe (conventional system only)	U3 / X2.13,14
E 25	Short circuit, water probe	U2 / X2.7,8,9
E 26	Wire break, water probe	U2 / X2.7,8,9
E 33	Compressor feedback missing	U2 / X1.15; X1.3
E 34	Auxiliary heating fault	U2 / X2.11-14; X1.1,2
E 35	Valve, roof channel (V2)	U2 / X3.11-15,21
E 36	Valve, driver's heating/cooling (V3) (cold water air conditioning only)	U2 / X3.1-5,21
E 37	Valve, convector (V4)	U2 / X3.16-20,21
E 38	Central valve (V5) (cold water air conditioning only)	U2 / X3.6-10,21
E 39	Valve, driver's heating (V1)	U1 / X3.16-20
E 40	Front box screen flap	U1 / X3.6-10
E 41	Front box footwell flap	U1 / X3.11-15
E 42	Fresh air flap left	U3 / X2.4-8
E 43	Fresh air flap right	U4 / X2.4-8
E 45	Valve, roof channel (V2) sticking	U2 / X3.11-15,21
E 46	Valve, driver's heating/cooling (V3) sticking (cold water air conditioning only)	U2 / X3.1-5,21
E 47	Valve, convector (V4) sticking	U2 / X3.16-20,21
E 48	Central valve (V5) sticking (cold water air conditioning only)	U2 / X3.6-10,21
E 49	Valve, driver's heating (V1) sticking	U1 / X3.16-20
E 50	Front box screen flap sticking	U1 / X3.6-10
E 51	Front box footwell flap sticking	U1 / X3.11-15
E 52	Fresh air flap left sticking	U3 / X2.4-8
E 53	Fresh air flap right sticking	U4 / X2.4-8
E 70	Front box blower fault	U1 / X2.3,4
E 71	Evaporator blower left fault	U3 / X2.12,17,19
E 72	Condenser blower left fault (conventional system only)	U3 / X2.15,18
E 73	Evaporator blower right fault	U4 / X2.12,17,19
E 74	Condenser blower right fault (conventional system only)	U4 / X2.15,18
E 85	General fault U2	
E 86	General fault U3	
E 87	General fault U4	
E 88	CAN bus error	

3.17 Programme -40-: Reset flap potentiometer P1 adjustment

(T8 – Previous value, T9 – Next value, T1 – Set to default value)

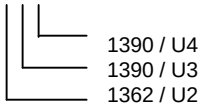
Sets the three reference positions of potentiometer P1. (Default: 0)

Display	Position for:
1xxx	100% foot
2xxx	Vertical
3xxx	100% screen

3.18 Programme -41-: CAN bus test

Shows all nodes currently connected to the CAN bus. A dash indicates a missing node.

e.g. u234



e.g. u2-4 = Node U3 missing

4 Comments

4.1 Bus type detection

The KR-490 climate control system is installed in various coaches. They are differentiated from one another by the air conditioning system fitted:

- Cold water cooled system R02 and R03
- Conventional air conditioning system R134a other vehicles

During the valve calibration process (CAL2), the climate control system detects from the number of valves which system is involved, and controls it accordingly.

If the valves V3 (driver's valve H/C) and V5 (central valve) are both missing from the system at the same time during calibration, the controller detects a conventional system. If the measured values for V3 and V5 are within the normal range, the controller detects a cold water air conditioning system.

4.2 Calibrating the valves (calibration CAL1, CAL2, CAL3)

When the KR-490 has been connected to the voltage supply, the unit checks the magnitude of the supply voltage and, if this is >24V, starts calibrating the directly connected valves and flaps. Display "CAL1". The display "_CAL" indicates that the supply voltage is too low.

The unit then checks the connection to the water station node U2. If this is present, the valves located there are calibrated. Display "CAL2".
If it is missing, the calibration is repeated as soon as the connection is detected.

Finally, the connection to the two roof nodes is checked. The roof flaps are not calibrated until both roof nodes have responded and the passenger area temperature is greater than 17°C or the external temperature is greater than 7°C. Display "CAL3".
If one or both nodes are missing or if both temperatures are too low, the calibration is postponed until these conditions are satisfied.

The calibration of the flaps and valves serves, on the one hand, to check the operation of the connected equipment and, on the other, to detect the end stops/valve angles. The calibration may take up to 2 minutes depending on the valve type.

If it should not be carried out correctly, this may lead to incorrect positioning of the flaps and valves, or to the pumps running, even though the valves are closed.

A recalibration of the valves and flaps is automatically initiated when a reset function is carried out (see 4.4). Calibration can also be initiated manually by means of test programme -11-.

Calibration is also carried out after an undervoltage and automatically once a week.

4.3 Auxiliary heater

The auxiliary heater is an independently operating unit. When switched on by the climate control system, only the electronic controller of the auxiliary heating unit is switched on (stand-by mode).

If the temperature of the water is too low, the auxiliary heater will fire automatically. If the water is already warm, the auxiliary heater will not fire.

As well as manual starting by means of the appropriate button, three starting times can be pre-programmed for the auxiliary heater.

This makes it possible to pre-heat the bus.

When the external temperature is less than 5°C and the front box temperature has been set to greater than 40°C, the controller switches the auxiliary heater to stand-by.

In the case of a cold water air conditioning system, if the central valve is moved to the cooling position in the course of the controlled process, the auxiliary heater will be interrupted until the valve is in the heating position once more.

With the appropriate wiring, the auxiliary heating mode will be activated when the external temperature is less than 4°C.

4.4 Reset function

If the buttons T1, T2 and T3 are pressed simultaneously when the engine is not running, the system will carry out a reset.

The control unit will indicate "0490" and will then start calibrating the valves. The fault memory, the current time of day and any programmed auxiliary heating times will be erased.

4.5 Emergency operation

If there is a fault on the CAN bus connection between the control unit and the roof nodes, this will be detected by the roof nodes and they will change over automatically to emergency operation, i.e. when the ignition is switched on, the roof fans will be switched to half speed as soon as the supply voltage is greater than 26.5 V. The fans will be switched off if the voltage drops below app. 25.3 V.

4.6 Filling mode

To fill the complete water circulation system, all water slide valves in the heating flow and return must be opened, and the cooling water compensation tank must be filled with a water-glycol mixture in accordance with the operating manual. The engine is then started and the KR-490 immediately set to the "Heating override" mode (see Item 1.2 T9). P2 (front box temperature setpoint) must also be set to the right-hand stop. This ensures that all water valves are opened. Running the engine at moderate speeds will accelerate the bleeding process. The water level in the compensation tank must be continuously monitored and topped up with coolant as required.

4.7 Special operation, air conditioning coupling

In order to prevent the air conditioning coupling shaft sealing ring from drying out, the air conditioning coupling is switched on for 3 minutes at intervals of no longer than 7 days when the water temperature, with the engine running, is between 10° and 50°C. This considerably reduces the unavoidable loss of coolant over the life of the vehicle.

4.8 Complete test

This test serves to provide a relatively quick overview of the operational capability of the ventilation and heating equipment and of the connected probes.
The test takes approximately 14 minutes.

The following conditions must be satisfied before starting the test:

- Ignition on, engine not running
- Door I and Door II open (front and rear entrance)
- Service flap / engine compartment flap open (for auxiliary heater, valves)

Start the test by pressing buttons T1 and T7 simultaneously.

While the test is running, "Test" will appear flashing in the display.

The test can be aborted by starting the engine, by turning the ignition off, by disconnecting the on-board power supply or by pressing the button combination again.

The following items are checked in the course of the test:

- On-board power supply greater than 23.5 V
- CAN bus communication
- Analogue inputs (probes and valve feedbacks)
- Valves (flow, feed: 90 sec in each case) - Water pump (5 sec)
- Water pump, roof (5 sec for cold water air conditioning)
- Auxiliary heater (40 sec for cold water)
- Condenser blower (10 sec for conventional system)
- Evaporator blower (left, right, 5 sec in each case)
- Heater (Door I and II, 10 sec each stage) or extractor blower
- Side panel heater (rear, front, 10 sec in each case)
- Front box blower, screen flap, driver's flap (30 sec in each case)

If the on-board power supply should fall too low at the beginning of or during the test, this will be indicated by a flashing "U". It is only possible to exit this state by pressing button T10.

Check list for complete test

Test	***Test date***						
Roof valve V2	(flow, feed)						
Driver's valve V1	(flow, feed)						
Driver's valve H/C V3	(flow, feed) (cold water air conditioning only)						
Convector V4	(flow, feed)						
Central valve V5	(flow, feed) (cold water air conditioning only)						
Water pump							
Roof water pump	(cold water air conditioning only)						
Auxiliary heating fires *Note: Auxiliary heater does not fire when the engine is hot.*							
Condenser blower	(if fitted)						
Heater, door II (exit) or extractor blower – Stage 1							
Heater, door II (exit) or extractor blower – Stage 2							
Roof blower left							
Roof blower right							
Side panel heater, rear - Stage 1	(if fitted)						
Side panel heater, rear - Stage 2	(if fitted)						
Side panel heater, front - Stage 1	(if fitted)						
Side panel heater, front - Stage 2	(if fitted)						
Heater, door I (entry) – Stage 1	(if fitted)						
Heater, door I (entry) – Stage 2	(if fitted)						
Front box driver's ventilation							
Front box screen ventilation, nozzles							
Front box screen and driver's ventilation							
Front box maximum blower power							
Faults reported							
Notes							

Test instructions

Please note that a certain period of time will be required for this test. If you are under time pressure, you should postpone this test until later.

If you think that your heating, ventilation and air conditioning system is not working properly, it is possible to carry out a complete test in a simple manner.

The following points must be observed before starting the test.

The test takes approximately 14 minutes.

The test should only be aborted in an extreme emergency in order to avoid malfunctions. If this should occur, however, the test should be repeated immediately.

The test can be aborted by starting the engine, by turning the ignition off, by disconnecting the on-board power supply or by pressing the button combination again.

Of course, the control system has its own continuous diagnostics, which it uses to detect various faults automatically when the engine is running. These are indicated with an E (error) together with an error number.

As you will be testing processes with this test, which cannot be monitored by the electronics, the following procedure must be observed:

-> Switch on the ignition.

-> Open doors I and II (front and rear entrances)

->Open the service and engine flap behind which the auxiliary heater and valves are located.

-> Start the test by pressing buttons T1 and T7 on the control unit simultaneously.

The message TEST will appear flashing in the display. Note: The test takes approximately 14 minutes.

If a flashing "U" appears in the display, the on-board voltage is too low for the test.

In this case, the condition should be cancelled with the button T10. A new test should not be performed until the battery has been recharged.

-> Now dismount from the vehicle and go to the engine compartment.

In the meantime, the operating unit will be testing the following:

After a waiting time of 3 sec, the CAN bus is tested (5 sec) and the analogue inputs (app. 7 sec)

After app. 15 sec:

All connected water valves open and close, one after the other.

The roof valve V2 opens (90 sec) and closes (90 sec)

The driver's valve V1 (in the front box) opens (90 sec) and closes (90 sec)

In the case of cold water air conditioning, the driver's valve H/C V3 opens (90 sec) and closes (90 sec)

The convector valve V4 opens (90 sec) and closes (90 sec)

In the case of cold water air conditioning, the central valve V5 opens (90 sec) and closes (90 sec)

The recirculated pump starts to run (5 sec) and one of the front box valves opens.

In the case of cold water air conditioning, the roof water pump then runs for 5 sec.

The heater fires (10 sec) and starts. (Note: It will not start if the engine is warm – ignore E34). The minimum burn time is 30 sec.

The heater goes off again at the end of this part of the test. Duration of test 40 sec. (Note: Pump and heater continue to run for app. 2 min).

The condenser fans on the roof (if fitted) are switched on for 10 sec. This is followed by a pause of 10 sec.

-> Now go to Door II (exit).

An optional heating or extractor blower is fitted in the area of the steps. If fitted, this runs for 10 sec in Stage 1 and then for 10 sec in Stage 2.

-> Now, in the 10 sec pause that follows, go inside and to the rear of the vehicle.

The evaporator fans inside the bus then each run for 5 sec at ½ speed.

First the left-hand blower (air must come out in the left half of the bus in the central aisle and by the windows). Then the right-hand blower (air must come out in the right half of the bus in the central aisle and by the windows).

After this, the rear side panel heaters (fans on the convectors) for 10 sec in Stage 1, then 10 sec in Stage 2. This is followed by the front side panel heaters for 10 sec in Stage 1, then 10 sec in Stage 2. (Side panel heaters are not fitted in all vehicles).

Pause for 30 sec.

-> Return to the driver's area.

An optional heating blower is fitted in the area of the steps at the entrance. If fitted, this runs for 10 sec in Stage 1 and then for 10 sec in Stage 2.

Finally, the front box is checked. The blower runs in the middle stage (Stage 5).

Check whether air comes out in the driver's footwell.

First of all the air only comes out in the driver's footwell area (30 sec), then only to the screen and the nozzles for the driver (30 sec).

After this, the air flows out everywhere (30 sec). The blower runs up to the maximum stage (Stage 10) for 30 sec and then stops.

End of test

If the system has not found any faults in this complete test, the message "OK" appears for 10 seconds at the end of the test.

Please be aware that the coolant circulation is not tested, as this is not allowed by law, and can only be checked by competent workshops and service centres.

If your system indicates an error or does not work properly, contact a service centre without delay.

5 Control

Abbreviations:

T_A = External temperature	T_W = Water temperature	T_V = Icing probe	T_R = Passenger area temperature
T_D = Roof channel temperature	T_K = Convector temperature	T_F= Front box probe	
T_S = Set temperature	T_{SD} = Set temperature, roof	T_{SK} = Set temperature, convector	T_{SF} = Set temperature, front box

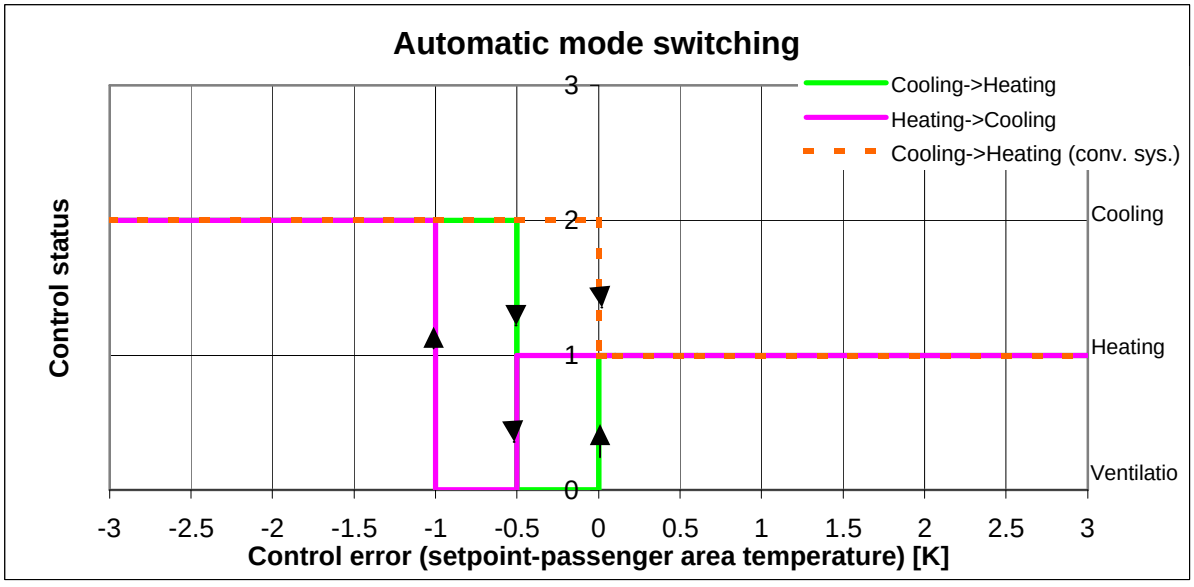
The setpoint used within the controller lags behind the value set on the control unit by app. 0.7 K/min when increasing, and it remains constant during the off period between cooling and heating.

The control (except the cooling) continues to operate for 10 minutes when the engine is switched off. After this, and when the ignition is switched on, the driver's and convector heating can be activated by switching on the auxiliary heater.

5.1 Automatic mode switching

When switching from Heating (H) -> Ventilation (V) -> Cooling (C) or C->V->H, the Ventilation state is maintained for at least 10 minutes.

The system will only change from V to C when the engine is running, the cooling has not been switched off and T_A > Air conditioning inhibit temperature + 2K.



5.2 Cooing system

Cold water air conditioning

Air conditioning enabled at T_W < 50°C
Compressor off at T_W < -5°C, re-enable compressor at T_W > 3°C
Minimum on/off time for compressor: 3 min.

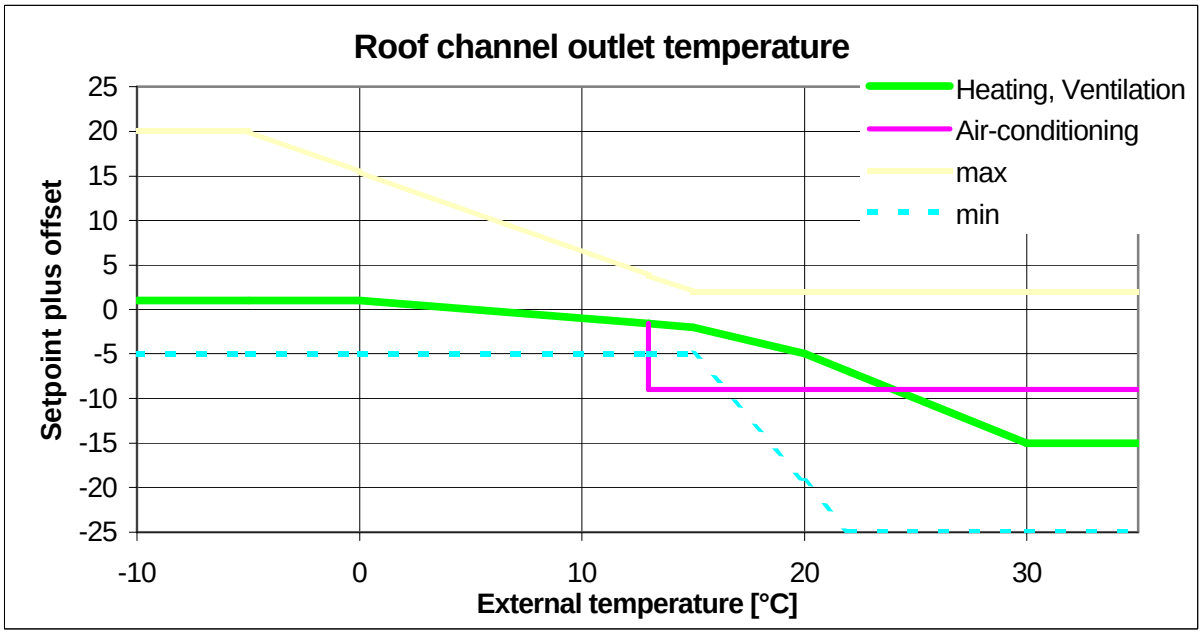
Conventional air conditioning system:

Condenser runs for 30 sec the first time the system is switched on after the engine has been started.
If the air outlet temperature in the roof channel falls too low, the roof valve may supply heat to counteract this.
Condensers continue to run for 30 sec.
Compressor minimum on/off time: 3 min.

Compressor off at $T_V < 0°C$, re-enable compressor at $T_V > 5°C$

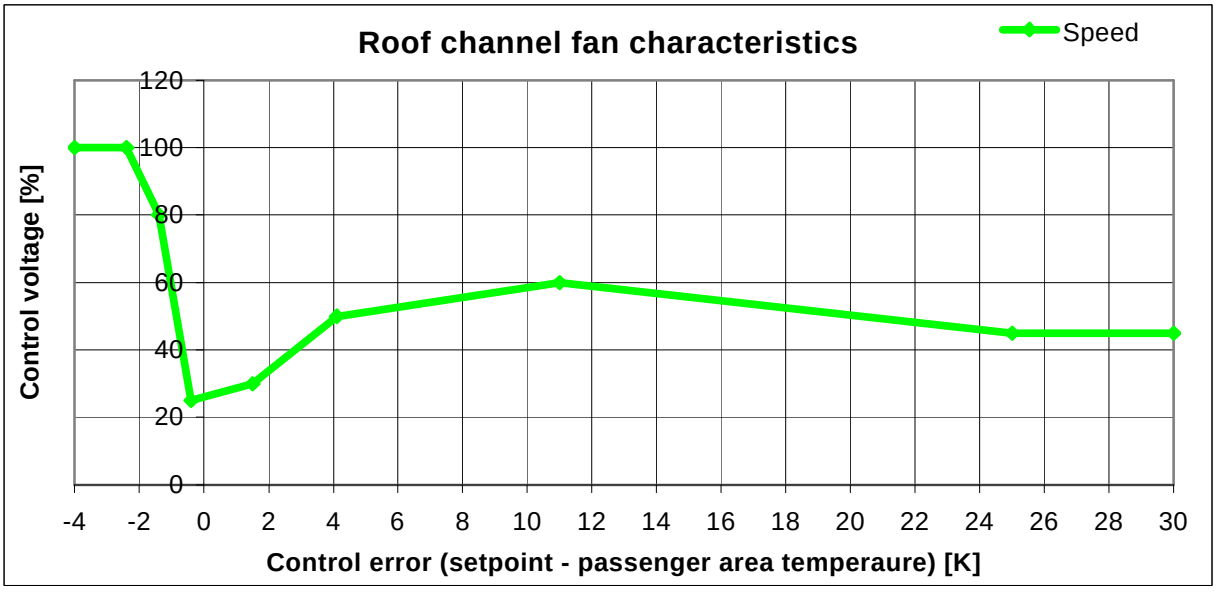
5.3 Roof channel outlet temperature

Integration constant 8 sec; Max. integration correction 5K
$T_{SD}max$ = 44°C, $T_{SD}min$ = 4°C
When heating: Cold water air conditioning: Integrates up from >1K deviation, integrates down for <1K.
Conventional system: Integrates up for 1K deviation, down for <0.5K.
When cooling: Cold water air conditioning: Integrates up from >-1K deviation, integral cancelled for <-1K.
Conventional system: Integrates up for -0.1 K deviation, down for <0K.



5.4 Roof channel blower characteristics

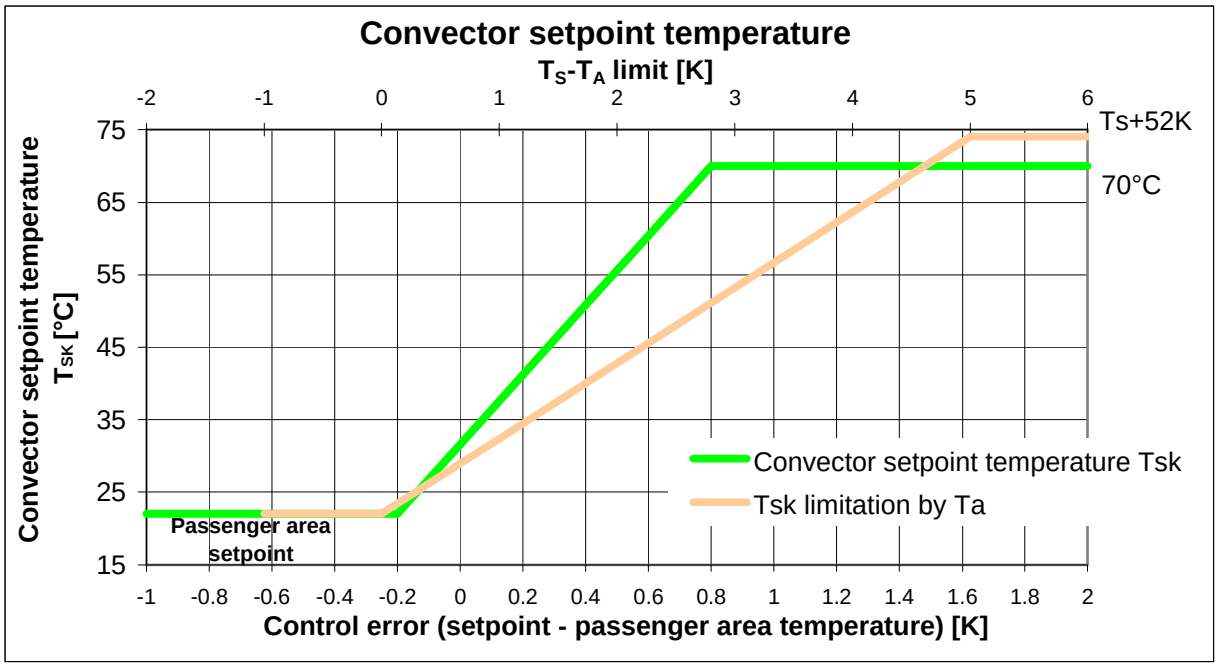
Ignition on: Off / Manual (max. G 5);
Engine running: 25% for (Tw < 50°, max. 30 min) otherwise characteristic, except override mode and manual
In manual mode and air conditioning: minimum stage G 3
Override heating 47% (parameter); Override cooling 100% (fixed)
Stepless, app. 0.4 %/sec.



5.5 Convector control

Only when heating active, otherwise valve closed
for (T_A < 2°C and passenger area integral > (integration limit/2)): 2-point control
for T_A > 4°C: Control mode according to setpoint below

2-point control: Valve 100% for T_R <= T_S – 0.8K ; Valve 0% for T_R >= T_S
Controlled mode: Control of convector temperature to convector setpoint temperature (see diagram)
Integration constant 16 sec; setpoint increased when T_K<T_{SK} at app. 1K/min
T_{SK}max = 70°C or T_S+52K, T_{SK}min = T_S passenger area



5.6 Central valve control (cold water air conditioning only)

0% Heating, 100% = Cooling

5.7 Boarding heater / Extractor blower

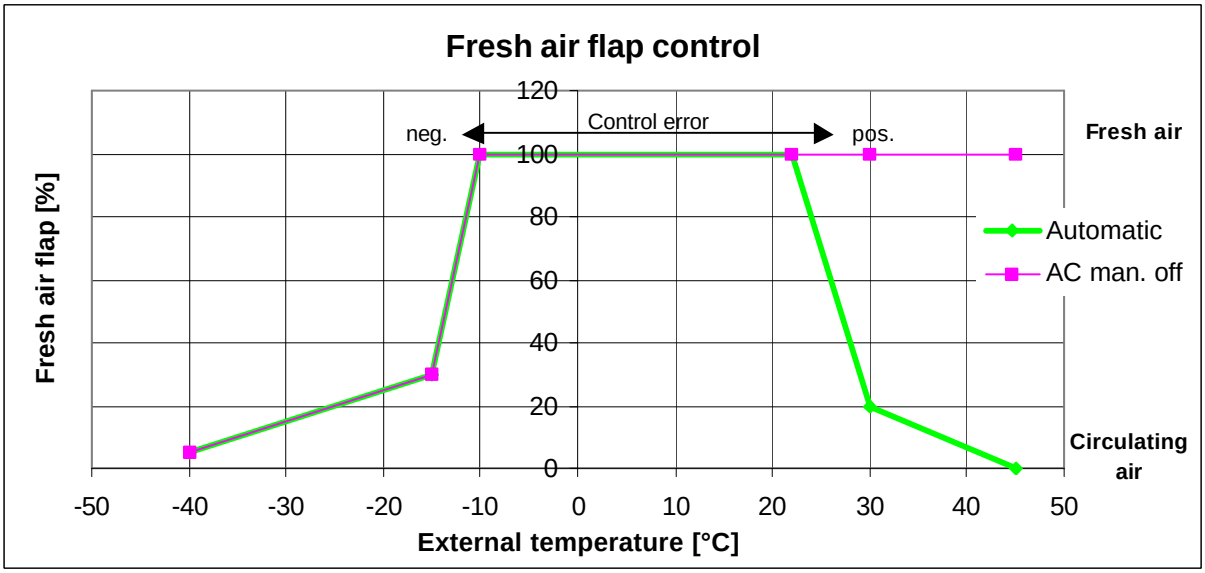
Adjustable: Boarding heater front + rear or boarding heater front + extractor blower (test programme -13-)
Default setting (***auto***): R02/R03 – Boarding heater, R07/R08/NAG/TOURLINER – Extractor blower

Boarding heater: Enable heater from Tw > 50°C or after 30 min
Stage 1 active when engine running and front box setpoint temperature greater than 40°C and external temperature less than 5°C.

Extractor blower: Stage 1 active when engine running (except cooling, and ventilation following cooling)
Stage 2 active when roof blower greater than 70% and fresh air flaps greater than 70%.

5.8 Fresh air flap control

Scan time 1/min, Automatic app. 10%/min, button immediate
When button pressed, air circulation (0%) for 15 min, thereafter automatic
When "Last door closing" signal received, moves quickly to air circulation (0%).
Ignition off: Recirculated air (0%), so that snow cannot be blown into the vehicle.
Ignition on, Engine running: 100% fresh air when in COOLING (Ts<Td-2K AND Ta<Tr-3K); otherwise characteristic (see below)



5.9 Front box control

No nodes connected = Transition mode: only V1 in open-loop mode
Cold water air conditioning:

Front box control every 4 sec, control valve used depends on T_A

When ignition on: When Ta < Air conditioning inhibit –8K: Heating with V3, otherwise closed

When engine running: T_A < Air conditioning inhibit –8K: Heating with V3; V1 closed

T_A > Air conditioning inhibit -2K: Heating/Reheat with V1, Cooling with V3 (0%, 100% only)

in the case of probe faults: open-loop operation of V1 or V3 depending on Ta

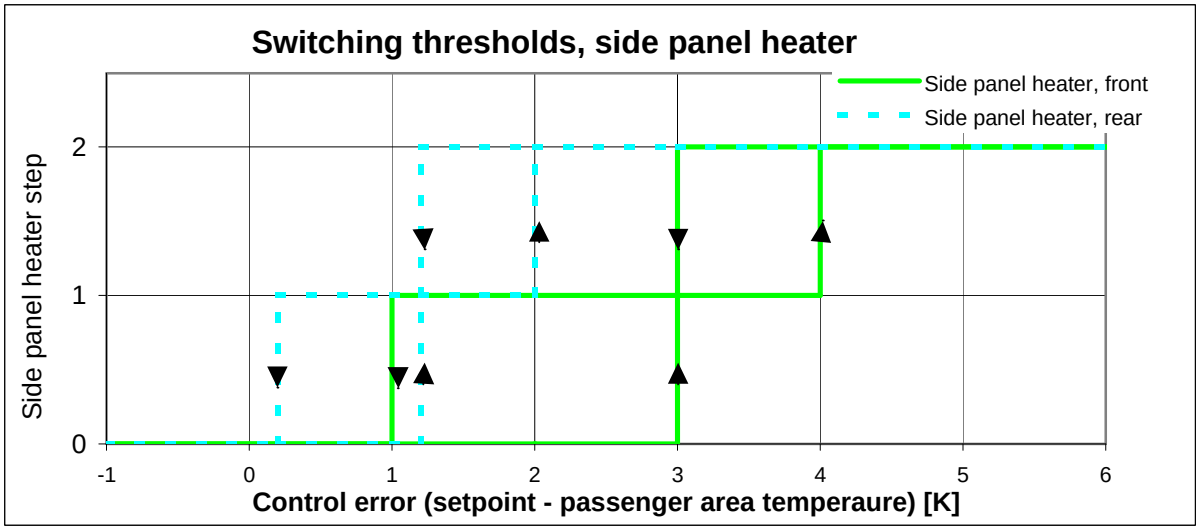
Conventional system:

Front box control every 4 sec with V1

in the case of probe faults: open-loop operation of V1

5.10 Side panel heaters in passenger footwell (cold water air conditioning only)

Enabled when engine running and heating on from Tw > 50°C or after 30 min
Enabled when Tk > 45°C, inhibited when Tk < 40°C



5.11 Parameter list (for test programme –18-)

Number	Description	Factory setting
1	Passenger area controller P-term	-2
2	Passenger area controller I-term	8
3	Passenger area controller integration limit	55 (5K)
4	Convector controller P-term	1
5	Convector controller I-term	13
6	Convector controller D-term	6
7	Roof controller P-term	-3
8	Roof controller I-term	3
9	Roof controller D-term	16
10	Front box controller P-term	-7
11	Front box controller I-term	6
12	Front box controller D-term	4
13	Suppress fault monitoring	off
14	Running time for front box recirculated air flaps	6 (seconds)
15	Auxiliary heating running time	60 (minutes)
16	Running time for manual air circulation in passenger area (button)	15 (minutes)
17	Comfort correction at -20°C	0
18	Comfort correction at 0°C	0
19	Comfort correction at 17°C	0
20	Comfort correction at 40°C	0
21	Blower characteristic control error 1	127 (25K)
22	Blower characteristic control error 2	60 (11K)
23	Blower characteristic control error 3	23 (4,1K)
24	Blower characteristic control error 4	8 (1,5K)
25	Blower characteristic control error 5	-2 (-0,4K)
26	Blower characteristic control error 6	-7 (-1,4K)
27	Blower characteristic control error 7	-12 (-2,4K)
28	Blower characteristic control error 8	-20 (-4K)

Number	Description	Factory setting
29	Blower characteristic control error 9 (not used)	-44 (-10K)
30	Blower characteristic control error 10 (not used)	-55 (-12K)
31	Blower characteristic control voltage for control error 1	45%
32	Blower characteristic control voltage for control error 2	60%
33	Blower characteristic control voltage for control error 3	50%
34	Blower characteristic control voltage for control error 4	30%
35	Blower characteristic control voltage for control error 5	25%
36	Blower characteristic control voltage for control error 6	80%
37	Blower characteristic control voltage for control error 7	99%
38	Blower characteristic control voltage for control error 8	99%
39	Blower characteristic control voltage for control error 9	99%
40	Blower characteristic control voltage for control error 10 (max)	99%
41	Blower offset at T_A>7°C	0 (0%)
42	Blower speed for heating override	120 (47%)
43	Tempering mode	off
44	Roof channel setpoint offset at T_A = 0°C	5 (1K)
45	Roof channel setpoint offset at T_A = 15°C	-11 (-2K)
46	Roof channel setpoint offset at T_A = 20°C	-27 (-5K)
47	Roof channel setpoint offset at T_A = 30°C	-84 (-15K)
48	Roof channel setpoint offset for air conditioning mode	-50 (-8K)
49	Automatic mode, heating on	0 (0K)
50	Automatic mode, heating off	-5 (-0,5K)
51	Automatic mode, cooling on	-11 (-1K)
52	Automatic mode, cooling off (cold water air conditioning only)	-5 (-0,5K)
53	Compressor inhibit temperature (0°C+x)	Cold water air conditioning: 13 (13°C) Conventional: 6 (6°C)
54	Compressor on when water temperature greater than (-10°C+x)	13 (3°C)
55	Compressor off when water temperature less than (-10°C+x)	5 (-5°C)
56	Compressor minimum running time	3 (minutes)
57	Compressor minimum stop time	3 (minutes)
58	Fresh air flap offset: Characteristic for: $T_A < T_R$ + xK	33 (3K)
59	Fresh air flap offset: Characteristic for: $T_S < T_D$ + xK	22 (2K)
60	Fresh air flap position for T_A = -40°C	5%
61	Fresh air flap position for T_A = -15°C	30%
62	Fresh air flap position for T_A = -10°C	99%
63	Fresh air flap position for T_A = 22°C	99%
64	Fresh air flap position for T_A = 30°C	20%
65	Fresh air flap position for T_A = 45°C	0%
66	Automatic mode, cooling off (conventional system only)	1 (0,1K)
67	Bus type (0 = undefined, 1 = cold water air conditioning, 2 = conventional)	0
68	Extractor blower (off = entry, auto = dependent on bus type, on = extractor)	auto

6 Fault monitoring

When the ignition is on and the engine is running, certain processes are monitored and any faults that occur are stored in the fault memory (RAM). The fault memory can be displayed and erased by service personnel in test mode (programme –31-).

6.1 Error numbers

See Chapter 3.16 (Test programme –31–) / Chapter 7 (Fault rectification)

6.2 Fault conditions / Error handling:

Probe faults: (E3-E26)
Monitoring for short circuit and breakage (or missing). Filtering 32 sec.
Probe faults are displayed in M490.

Air conditioning feedback signals: (E33)
Monitoring of the compressor via pressure switches with the air conditioning system running.
If a pressure switch disconnects the output from the compressor, this is detected from the pressure switch feedback.
Filtering: 4 sec; Fault generated for 3 occurrences within 10 min; Compressor inhibited for continuous control; Fresh air operation.
Immediate display during operation.
Compressor enabled by turning the ignition off and restarting the engine.

Valve/flap potentiometers: (E35-E43)
Monitoring of potentiometer feedback signals for short circuit and breakage as well as the minimum travel distance during calibration.

Sticking valves/flaps: (E45-E53)
Monitoring of the valve travel range in 3 segments.
If the valve position setpoint and the valve feedback remain in different segments for more than 2 minutes, the controller assumes that the valve has stuck.
Three complete opening and closing actions are carried out in quick succession to unstick the motor.
Fault generated on the third jam. In spite of this, valves/flaps continue to be used.
Three more attempts to break free are possible when the ignition is switched on again.

Blower faults: (E70-E74)
Feedback output of the appropriate speed module indicates a fault (24V).
Filtering 0.5 sec.

CAN error: (E85-E88)
Monitoring for the presence of all nodes. Filtering 4 sec.
If the connection between the control unit and the nodes is interrupted, the node will switch to emergency mode after 10 sec.

7 Fault rectification

<u>Comment:</u> All screens (where provided) for the probe cables and the water valve potentiometer feedback cables must only be connected to the vehicle ground/earth at the air conditioning controller/node. Ground/earth connections within the vehicle (framework) may lead to uncontrolled alarms and malfunctions.

E3 ***Short circuit, external probe***
Position: Beneath front of vehicle (external)
Connection: KR490/U1 X1.8, 5
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E4 ***Wire break, external probe***
Position: Beneath front of vehicle (external)
Connection: KR490/U1 X1.8, 5
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on KR490/U1 or check probe.
Check cable over its whole length.

E5 ***Short circuit, passenger area probe***
Position: In passenger monitoring box
Connection: 1390/U4 X2.13, 14
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E6 ***Wire break, passenger area probe***
Position: In passenger monitoring box
Connection: 1390/U4 X2.13, 14
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on 1390/U4 or check probe.
Check cable over its whole length.

E7 ***Short circuit, roof channel probe***
Position: In the right-hand roof channel by about the 5th row of seats
Connection: 1390/U4 X3.10, 11
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E8 ***Wire break, roof channel probe***
Position: In the right-hand roof channel by about the 5th row of seats
Connection: 1390/U4 X3.10, 11
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on 1390/U4 or check probe.
Check cable over its whole length.

E9 ***Short circuit, convector probe***
Position: On right-hand convector, rear
Connection: 1362/U2 X1.9, 6, 11
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E10 ***Wire break, convector probe***
Position: On right-hand convector, rear
Connection: 1362/U2 X1.9, 6, 11
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on 1362/U2 or check probe.
Check cable over its whole length.

E21 ***Short circuit front box probe driver's area***
Position: In front box
Connection: KR490/U1 X2.5, 6
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E22 ***Wire break front box probe driver's area***
Position: In front box
Connection: KR490/U1 X2.5, 6
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on KR490/U1 or check probe.
Check cable over its whole length.

E23 ***Short circuit icing probe (conventional system only)***
Position: In the heat exchanger
Connection: 1390/U3 X3.13, 14
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E24 ***Wire break icing probe (conventional system only)***
Position: In the heat exchanger
Connection: 1390/U3 X3.13, 14
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on 1390/U3 or check probe.
Check cable over its whole length.

E25 ***Short circuit, water probe***

Position: On the feed pipe, near auxiliary heater
Connection: 1362/U2 X2.7, 8, 9
Cause: Probe cable defective.
Remedy: Insulate or change cable.

E26 ***Wire break, water probe***

Position: On the feed pipe, near auxiliary heater
Connection: 1362/U2 X2.7, 8, 9
Cause: A wire from the probe has come loose
Plug broken
Cable severed
Remedy: Check plug on 1362/U2 or check probe.
Check cable over its whole length.

E33 ***Air conditioning compressor feedback missing***

Position: Engine compartment, on the right-hand side in the direction of travel, at the side of the engine.
Connection: 1362/U2 X1.15, X1.3
Cause: Pressure switch for overpressure and underpressure defective
Air conditioning compressor fuse blown
Risk of icing:
Air throughput too low,
Evaporator blower or condenser blower tripped
Condenser blower not connected correctly
Freewheel diode missing from the air conditioning coupling
Recirculated air/fresh air flap not connected correctly
Feedback from air conditioning coupling to 1362/U2 interrupted
Air conditioning compressor V-belt defective.
Icing probe defective. (conventional system only)
Remedy: Check pressure switch for overpressure and underpressure
Check air conditioning compressor fuse and replace if necessary
Check air conditioning compressor filling level
Check evaporator and condenser blower and replace if necessary
Check filter mat and clean or replace if necessary
Check air conditioning coupling (freewheel diode present?)
Check recirculated air/fresh air flap
Check air conditioning compressor V-belt
Check icing probe. (Test programme P6 - see instructions)
Comment: The icing probe is only fitted in conventional air conditioning systems.

E34 ***Auxiliary heating (Webasto),***
Feedback missing or system did not fire during the complete test

Position: On the water station in the engine compartment or in a separate compartment in the immediate vicinity of the engine compartment
Cause: Water temperature already at setpoint (NO fault present)
Control unit failed
Fuel feed interrupted
Burner head defective
Remedy: In the case of a separate diesel tank, check level and fuel tap
Check burner head
Check feedback at water station node U2

E35 ***Potentiometer on the proportional valve for the roof channel defective (V2)***

Position: In engine compartment
Connection: 1362/U2 X3.11-15, 21
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E36 ***Potentiometer on the proportional valve for the driver's area heating/cooling defective (V3)***

Position: In engine compartment (cold water air conditioning only)
Connection: 1362/U2 X3.1-5, 21
Cause: Valve not fitted (system wrongly configured)
Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E37 ***Potentiometer on the proportional valve for the convector defective (V4)***

Position: In engine compartment
Connection: 1362/U2 X3.16-20, 21
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E38 ***Potentiometer on the proportional valve for the central valve defective (V5)***

Position: In engine compartment (cold water air conditioning only)
Connection: 1362/U2 X3.6-10, 21
Cause: Valve not fitted (system wrongly configured)
Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E39 ***Potentiometer on the proportional valve for the driver's area defective (V1)***

Position: In front box (cold water air conditioning) / in engine compartment (conventional system)
Connection: 0490/U1 X3.16-20 (cold water air conditioning)/1362/U2 X3.1-5, 21 (conventional system)
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E40 ***Potentiometer on front box screen flap defective***

Position:	In front box
Connection:	0490/U1 X3.6-10
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E41 ***Potentiometer on front box footwell flap defective***

Position:	In front box
Connection:	0490/U1 X3.11-15
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E42 ***Potentiometer on left-hand roof fresh air flap defective***

Position:	In left-hand roof channel
Connection:	1390/U3 X2.4-8
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E43 ***Potentiometer on right-hand roof fresh air flap defective***

Position:	In right-hand roof channel
Connection:	1390/U4 X2.4-8
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E45 ***Proportional valve, roof channel (V2) sticking***

Position: In engine compartment
Connection: 1362/U2 X3.11-15, 21
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E46 ***Proportional valve, driver's heating/cooling (V3) sticking***

Position: In engine compartment (cold water air conditioning only)
Connection: 1362/U2 X3.1-5, 21
Cause: Valve not fitted (system wrongly configured)
Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E47 ***Proportional valve, convector (V4) sticking***

Position: In engine compartment
Connection: 1362/U2 X3.16-20, 21
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E48 ***Proportional valve, central valve (V5) sticking***

Position: In engine compartment (cold water air conditioning only)
Connection: 1362/U2 X3.6-10, 21
Cause: Valve not fitted (system wrongly configured)
Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E49 ***Proportional valve, driver's area (V1) sticking***

Position: In front box (cold water air conditioning) / in engine compartment (conventional system)
Connection: 0490/U1 X3.16-20 (cold water air conditioning)/1362/U2 X3.1-5, 21 (conventional system)
Cause: Plug not properly inserted
Valve defective or stiff.
Cable trapped or broken
Motor valve opening angle too small
Remedy: Check plug, valve and cable
Replace motor valve if necessary.

E50 ***Front box screen flap sticking***

Position:	In front box
Connection:	0490/U1 X3.6-10
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E51 ***Front box footwell flap sticking***

Position:	In front box
Connection:	0490/U1 X3.11-15
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E52 ***Left-hand roof fresh air flap sticking***

Position:	In left-hand roof channel
Connection:	1390/U3 X2.4-8
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E53 ***Right-hand roof fresh air flap sticking***

Position:	In right-hand roof channel
Connection:	1390/U4 X2.4-8
Cause:	Plug not properly inserted
	Flap motor defective or stiff.
	Cable trapped or broken
	Flap opening angle too small
Remedy:	Check plug, flap and cable
	Replace flap motor if necessary.

E70 ***Front box blower fault***
Position: In front box
Connection: 0490/U1 X2.4,5
Cause: Cable trapped or broken
Front box blower defective or jammed
Speed module defective or overheated
Remedy: Replace front box blower if necessary
Replace speed module if necessary

E71 ***Evaporator blower left fault***
Position: In left-hand roof channel
Connection: 1390/U3 X2.12,17,19
Cause: Cable trapped or broken
One or more fans defective or jammed
One or more speed modules defective or overheated
Remedy: Replace appropriate blower if necessary
Replace appropriate speed module if necessary

E72 ***Condenser blower left fault***
Position: In roof system (conventional system)
Connection: 1390/U3 X2.15,18
Cause: Cable trapped or broken
One or more fans defective or jammed
One or more speed modules defective or overheated
Remedy: Replace appropriate blower if necessary
Replace appropriate speed module if necessary

E73 ***Evaporator blower right fault***
Position: In right-hand roof channel
Connection: 1390/U4 X2.12,17,19
Cause: Cable trapped or broken
One or more fans defective or jammed
One or more speed modules defective or overheated
Remedy: Replace appropriate blower if necessary
Replace appropriate speed module if necessary

E74 ***Condenser blower right fault***
Position: In roof system (conventional system)
Connection: 1390/U4 X2.15,18
Cause: Cable trapped or broken
One or more fans defective or jammed
One or more speed modules defective or overheated
Remedy: Replace appropriate blower if necessary
Replace appropriate speed module if necessary

E85 ***General fault 1362 / U2***

Position: Right rear side flap

Cause: Supply voltage missing
CAN bus connection defective

Remedy: Check supply voltage on 1362/U2
Check fuse in adjacent switch panel and replace if necessary
Check CAN bus plug on 1362/U2 or 1390/U4
Check CAN cable between 1362/U2 and 1390/U4
Check terminating jumper

E86 ***General fault 1390 / U3***

Position: In roof system

Cause: Supply voltage missing
CAN bus connection defective
1390/U4 coding defective

Remedy: Check supply voltage on 1390/U3
Check fuse in adjacent switch panel and replace if necessary
Check CAN bus plug on 1390/U3 or 0490/U1
Check CAN cable between 1390/U3 and 0490/U1
Check coding jumper on 1390/U4
Check terminating jumper

E87 ***General fault 1390 / U4***

Position: In roof system

Cause: Supply voltage missing
CAN bus connection defective
Coding defective

Remedy: Check supply voltage on 1390/U4
Check fuse in adjacent switch panel and replace if necessary
Check CAN bus plug on 1390/U4 or 1390/U3
Check CAN cable between 1390/U4 and 1390/U3
Check coding jumper
Check terminating jumper

E88 ***CAN bus error (multiple fault)***

Cause: More than one general fault (see E85, E86, E87)

Remedy: With the ignition on, check which nodes do not respond using test programme P-41, then check as necessary (see E85, E86, E87)
Check terminating jumper

8 M490 – Update / Diagnostics software

8.1 Software updates for KR-490

The software update works as follows:

When using a laptop, the external power supply should be connected for safety reasons, as otherwise the programme may be interrupted due to the power saving mode.

1. Connect the already booted-up laptop to the KR-490 via the serial interface.

2. Start M490.EXE in a DOS window (can also be full screen).

3. Select FLASH LOADER

4. Select SELECT 90FX FILE
-> e.g. Select file 04900409

5. Select 90FX TERMINAL

6. Reset KR-490 (Press T1+T2+T3 simultaneously or turn main battery switch off and on again)
-> as soon as the start message appears (on the laptop) press ESC (time window 0.5 sec after the unit starts!!)
=> Display "L A E
: "
if not, ESC was pressed too late = reset again etc.

7. Press Shift+E (upper case E)
=> Display "++++" (after app. 5 sec)

8. Press PAGE DOWN
=> Display "//+" several times; this can take some time.
=> then DL OK. (Download complete)

Note! If the message DL BAD appears, repeat procedure from 7.

9. Shift+A (upper case A)
=> KR490 restarts

10. Exit 90FX TERMINAL with the END key, ESC to main menu

8.2 Recording measured data with the KR-490

1. Connect the already booted-up laptop to the KR-490 via the serial interface.

2. Start M490.EXE in a DOS window (can also be full screen).

3. Select MEASURE, SAVE MEASURED DATA, enter report information (memory time scale 1), START DATA GATHERING

Note: The time scale for the recording (in BASIC SETTINGS) should be "seconds". A measurement file should not be longer than about 45 minutes. After this, start a new measurement file. When measuring the settling behaviour of the heating or cooling system, measurements should be taken for at least 1 hour with one file after reaching the desired temperature.

4. On completion of the measuring process, the data can be analysed using EVALUATION, DIAGRAM ON SCREEN.

8.3 Fault indication in the M490:

Who is there?

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
n.c.	n.c.	n.c.	n.c.	U2 Water station node	U4 Roof node	U3 Roof node	U1 Control unit

Short circuit fault / Wire break fault:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fresh air flap right	Water probe	Icing probe	Convector probe	Front box probe	Channel probe	Passenger area probe	External probe

Valve fault:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fresh air flap left	Front box footwell flap	Front box screen flap	Driver's valve	Central valve	Convector valve	Driver's valve H/C	Roof valve

Motor sticking 2:

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Convector valve	Roof valve	Central valve	Driver's valve H/C	Driver's valve	Front box footwell flap	Front box screen flap	Front box recirculated air flap

Motor sticking 1:

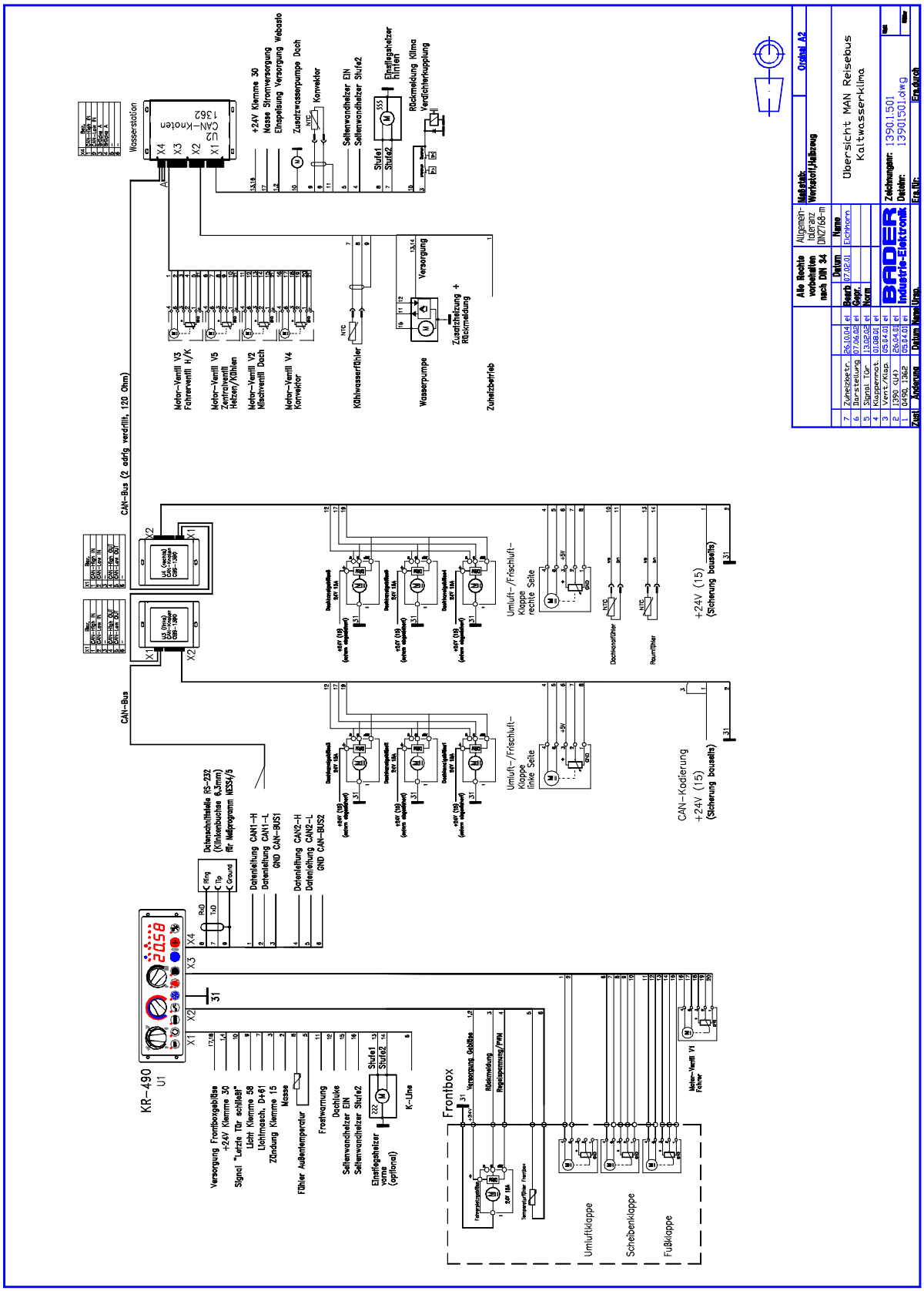
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	Fresh air flap right	Fresh air flap left	Spare valve

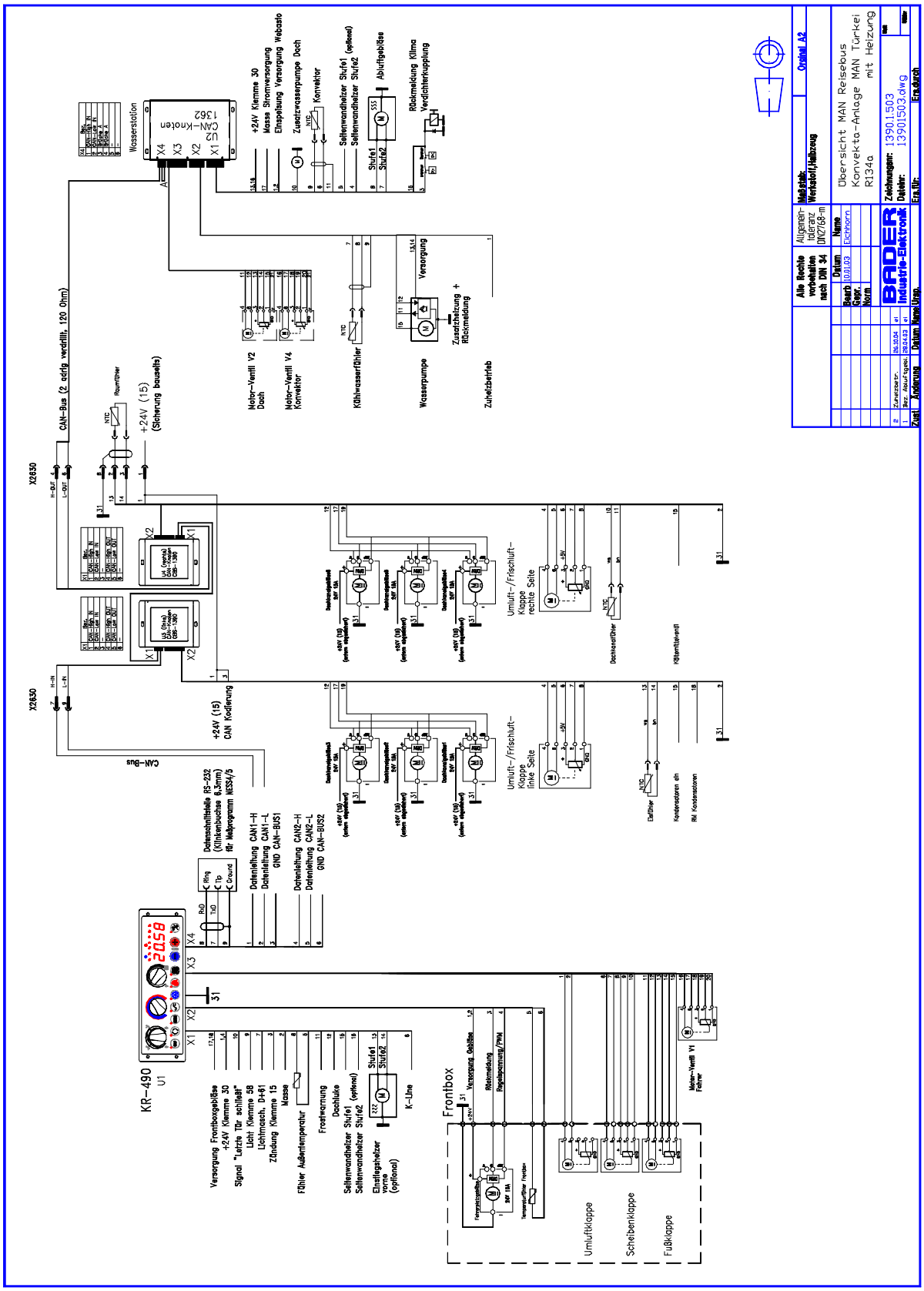
8.4 Other displays in the M490

System status: *0* Switch-on test (EEPROM progr.) / *1* Ignition off / *2* Ignition on / *3* Engine running (control) / *4* Test mode / *5* Undervoltage / *6* Manufacturing test / *7* Programming mode / *8* Power-on test

Control status: *0* Ventilation / *1* Heating / *2* Cooling
Air conditioning status: *0* Off / *1* Air conditioning on / *2* Fault

9 Wiring schematic

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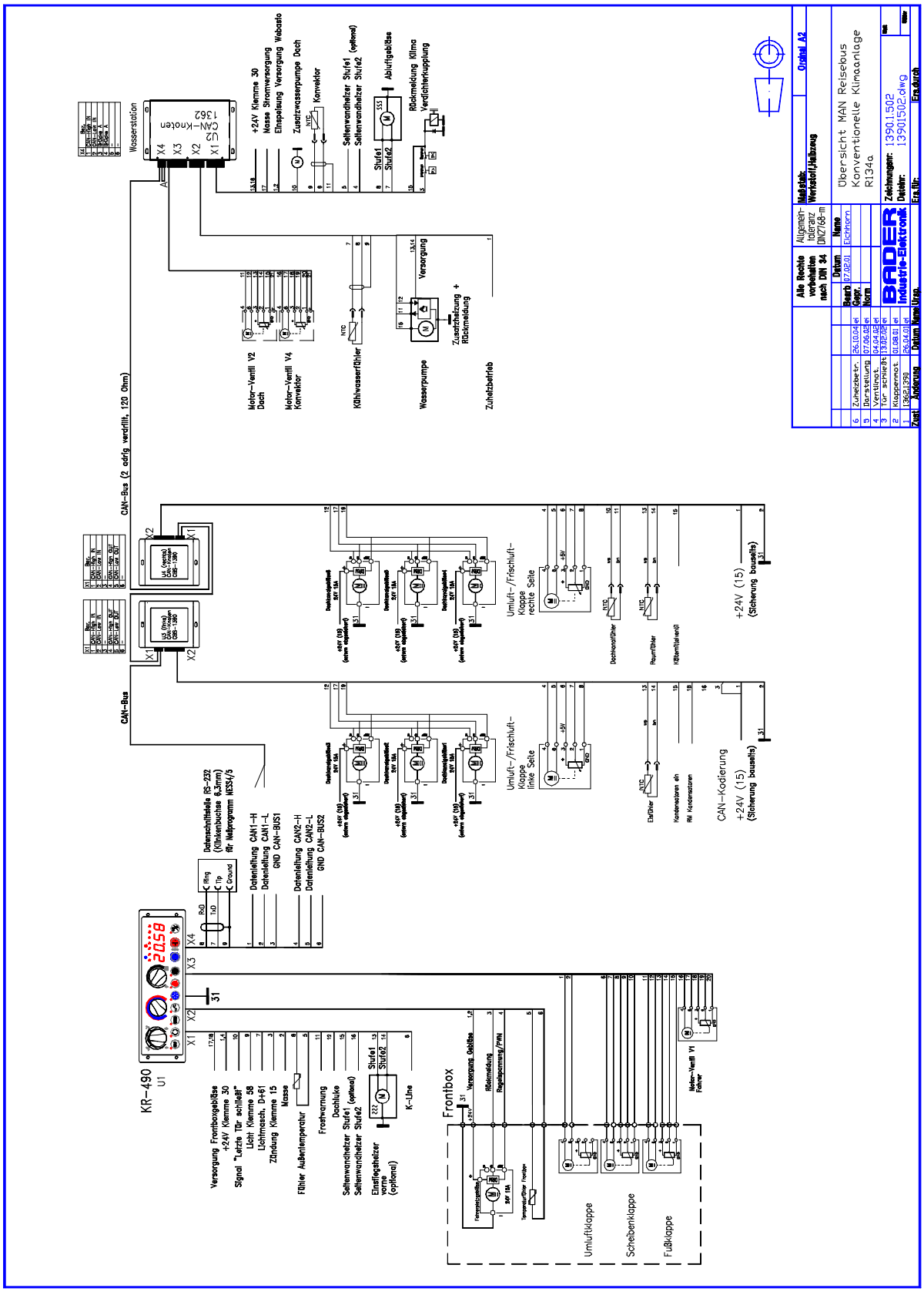
Konvekta-Anlage MAN Türkei
R134a mit Heizung
Zeichnungsnr.: 13901503
Datei: 13901503.dwg
BADER Industrie-Elektronik
Frontbox
KR-490
CAN-Bus (2 adrig verdrillt, 120 Ohm)
+24V (15) (Steuerung bauseits)
+24V (15) CAN Klemmung
CAN-Bus
Wasserstation
Motor-Ventil V2 Dach
Motor-Ventil V4 Konvektor
Kühlwasserfühler
Wasserpumpe
Zuheizbetrieb
Umluft-/Frischluft-Klappe rechte Seite
Umluft-/Frischluft-Klappe linke Seite
Umluftklappe
Scheibenklappe
Fußklappe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Konventionelle Klimaanlage
R134a
Zeichnungsnr.: 13901502
Datei-Nr.: 13901502.dwg
BADER
Industrie-Elektronik
Wasserstation
CAN-Bus (2 adrig verdrillt, 120 Ohm)
CAN-Bus
KR-490
Frontbox
Umluftklappe
Scheibenklappe
Fußklappe
Motor-Ventil V2 Dach
Motor-Ventil V4 Konvektor
Kühlwasserthiler
Wasserpumpe
Zuheizbetrieb
Umluft-/Frischluft-Klappe rechte Seite
Umluft-/Frischluft-Klappe linke Seite
CAN-Kodierung
+24V (15) (Sicherung bauseits)
Datenschnittstelle RS-232 (Klinkenbuchse 6.3mm) für Meßprogramm WCSV/5
Datenleitung CAN1-H
Datenleitung CAN1-L
GND CAN-BUS1
Datenleitung CAN2-H
Datenleitung CAN2-L
GND CAN-BUS2
Versorgung Frontboxgebläse +24V
Klemme 30
Signal "Letzte Tür schließt"
Licht Klemme 58
Lichtmasch. D+/61
Zündung Klemme 15
Masse
Fühler Außenlampenrohr
Frostwarnung
Dachluke
Sellenwandheizer Stufe1 (optional)
Sellenwandheizer Stufe2
Einstiegsheizer vorne (optional)
K-Line
Stufe1
Stufe2
Motor-Ventil V1 Fahrer
Zusatzwasserpumpe Dach
Konvektor
Ablufgebläse
Rückmeldung Klima Verdichterkupplung
Zuheizbetrieb
Rückmeldung Ventilator
Rückmeldung Regelspannung PWM
Versorgung Gebläse
Dachkondthiler
Raumthiler
Kühlwasserthiler
Elektronik