Autoplugin RCP-V5

Version 7.1

Technical Description
User Manual

Rev. A

Table of Contents

Description

The **Autoplugin RCP-V5** is electronic module designed for remote control connection to the fuel-fired heater (parking heater, fuel operated heater, pre-heater), factory installed in **Volvo S90** (2016-), **V90** (2016-) or **XC90** (2015-). The device controls the heater via CAN-bus.

Module Possibilities

- Set of inputs for additional remote control connection
- Set of outputs with programmable heater status signals
- Embedded remote control by using a car's remote control key
- Additional protection of the car's battery from discharging by inspecting of voltage level and time of autonomous operation of the heater

Package Content

1. Autoplugin RCP-V5 module (0114-1100)
2. Wiring for permanent connection
3. Technical Description brochure
4. Installation Manual brochure

Basic Functions

1. To start the heater by using car's remote control key press "Lock" button 3 times. Time intervals between presses must not exceed 20 seconds. The excess of time interval restarts the counter of "Lock" button presses. Car confirms commands reception with hazard signals flashing.
2. To stop the heater by using car's remote control key press "Unlock" button 3 times. Time intervals between presses must not exceed 20 seconds. The excess of time interval restarts the counter of "Unlock" button presses. Car confirms commands' reception with hazard signals flashing.
3. It is possible remotely disable startups of the heater, programmed in the CIP. Use remote control key to send stop command when the heater is idle. Starting the heater any way or turning the ignition to "on" position enables CIP timers again.
4. Additionally installed button can be connected to the module. The button is used for immediate start and stop of the heater. Button pressing changes heater condition to another one: switches off operated heater or switches on idle heater.
5. If additional remote control connected to the RCP, its functionality depends on connection schemes, module settings and the remote control possibilities. See remote control documentation for details.

Additional Functions

By default RCP adjusted to perform only basic functions, such as start and stop of the heater from the remote control key. To turn on the additional functions such as battery monitoring, flashing with direction indicators in rearview mirrors, etc. enter the module into Setup mode and activate corresponding setup item (see settings table 3).

Programming button and the brake pedal are used to enter Setup mode and to the settings change. Use additionally installed button as programming button.

It is necessary to stop the engine and the heater before. Turn the ignition on by holding engine start button for 2 seconds at least, then press and hold the brakes pedal. Press the programming button for 3 times (each time hold the button until LED goes off, about 1.5 seconds). The LED will go on confirming the Setup mode entering. Release the brakes pedal.

Each setup item in the settings table is a 3-digit code. To enter a digit of a code, shortly press the programming button so many times, as corresponds to a digit. The LED confirms each button press by going off briefly. To complete a digit entering, press and release brakes pedal. The module confirms it with one brief flash of the LED. When all three digits entered, the module checks the code for validity and confirms valid code with double LED flashing.

If entered digit is not correct, enter the code once more in that case. Several codes can be entered without exit of setup mode.
Turn the ignition off to exit setup mode. New settings are saved in nonvolatile memory of the module and stored there regardless of whether the module is connected or not to the car. **Note:** If you start the engine during Setup mode, new settings will not be saved in memory.
To reset the module to the factory settings, enter the code 8.1.1. The LED should flash three times, confirming command execution. Then the module exits Setup mode and restarts.

Settings Table (3)

Settings Group	**Settings Item**	**Possible Values**
1. Heater operation time	**1.1.** Limitation of heater total operational time in pre-heat mode	**1.1.1** *Not adjusted **1.1.2** 40 minutes **1.1.3** 50 minutes **1.1.4** 60 minutes **1.1.5** 70 minutes **1.1.6** 80 minutes **1.1.7** *90 minutes* **1.1.8** 100 minutes **1.1.9** 120 minutes
	1.2. Limitation of heater 1-cycle operational time in pre-heat mode	**1.2.1** 10 minutes **1.2.2** 15 minutes **1.2.3** 20 minutes **1.2.4** 25 minutes **1.2.5** 30 minutes **1.2.6** 40 minutes **1.2.7** 50 minutes **1.2.8** **Not used*
	2.1. “Lock” and “Unlock” buttons functions for heater control	**2.1.1** *”Lock” button for heater start, “Unlock” button for heater stop **2.1.2** “Unlock” button for heater start, “Lock” button for heater stop
	2.2. Number of sequential “Unlock” button presses for heater control	**2.2.1** Combination disabled **2.2.2** * *Two presses* **2.2.3** Three presses **2.2.4** Four presses
	2.3. Number of sequential “Lock” button presses for heater control	**2.3.1** Combination disabled **2.3.2** **Two presses* **2.3.3** Three presses **2.3.4** Four presses
3. Battery	**3.1.** Minimal battery	**3.1.1** * Not adjusted **3.1.2** 11.7V

Monitoring	voltage that lets the module start the heater in pre-heat mode	**3.1.3** 11.8V **3.1.4** 11.9V **3.1.5** *12.0V* **3.1.6** 12.1V **3.1.7** 12.2V **3.1.8** 12.3V **3.1.9** 12.4V
	3.2. Minimal battery voltage that lets the module keep operating the heater in pre-heat mode [2]	**3.2.1** * Not adjusted **3.2.2** 11.4V **3.2.3** 11.5V **3.2.4** 11.6V **3.2.5** *11.7V* **3.2.6** 11.8V **3.2.7** 11.9V **3.2.8** 12.0V
4. Timer_Out line control	**4.1.** Activate the Timer_Out line by time of the heater autonomous operation	**4.1.1** *Don't activate **4.1.2** In 10 minutes after heater startup **4.1.3** In 15 minutes after heater startup **4.1.4** In 20 minutes after heater startup **4.1.5** In 25 minutes after heater startup **4.1.6** In 30 minutes after heater startup **4.1.7** In 40 minutes after heater startup **4.1.8** In 50 minutes after heater startup **4.1.9** In 60 minutes after heater startup
	4.3. Activate the Timer_Out line by the second start command	**4.3.1** *Off **4.3.2** On
6. Indication of the heater status by using the car's hazard flashers [6]	**6.1.** Indication of heater startup	**6.1.1** *Off **6.1.2** Five flashes
	6.2. Indication of command reception from a remote control	**6.2.1** *Off **6.2.2** Three flashes
	6.3. Indication of heater operation, when starting source is remote controller	**6.3.1** *Off **6.3.2** On
	6.4. Indication of heater operation, when starting source is CIP (direct or timer start)	**6.4.1** *Off **6.4.2** On
	6.5. Indication of heater operation, when starting source	**6.5.1** *Off **6.5.2** On

	is other than specified in 6.3,6.4	
	6.7. Flashing frequency for 6.3-6.4 Setup items	**6.7.1** One flash within 3 sec **6.7.2** One flash within 5 sec **6.7.3** ** One flash within 10 sec* **6.7.4** One flash within 15 sec
7. Output signals adjustment	**7.3.** Notification signals on the output "Alert_1" [2]	**7.3.1** *"Heater started" **7.3.2** "Heater stopped" **7.3.5** "Heater started to burn" **7.3.7** "Error occurred" **7.3.8** Disable the output
	7.4. Notification signals on the output "Alert_2"	**7.4.1** "Heater started" **7.4.2** *"Heater stopped" **7.4.5** "Heater started to burn" **7.4.7** "Error occurred" **7.4.8** Disable the output
	7.5. Signal feed to the output "Status Minus"	**7.5.1** Heater operates (potential) **7.5.2** *Heater operates autonomously (from battery, engine is off) (potential) **7.5.3** Flashers control signal (double impulses with the frequency adjusted by 6.7, applying settings 6.3-6.5)[3] **7.5.4** Engine runs (potential) **7.5.5** Engine runs (RPM impulses) **7.5.6.** Disable the output
	7.6. Signal feed to the output "Status_Plus"	**7.6.1** Heater operates (potential) **7.6.2** Heater operates autonomously (from battery, engine is off) (potential) **7.6.3** Engine runs (potential) **7.6.4** Ignition is on (potential) **7.6.5.** Disable the output
8. Service menu	**8.1.** Default Settings	**8.1.1** Apply factory settings

* Factory setting
Recommended settings marked in italics

[1] –RCP turns off the heater if the battery voltage lowers below preset
[2] – Signals appear only during heater autonomous operation
[3] – Signal is used for indication by the hazard flashers. It uses 1-wire connection to the hazard alarm button (see installation manual for details)
[4] – Additional connections are required (see installation manual)

Signals

The module has two connectors: 9-pin connector X1 (table 1) for input signals and power connection, 10-pin connector X2 (table 2) for output signals, special signals and CAN-bus connection. The connector's first pin is marked by the key.

X1.1 Heater_off+[1]
The input can be used to switch off the heater, operated in pre-heat mode, with the impulse of positive polarity (the input **Heater_off**- in that case has to be connected to the Ground). The heater is stopped by the leading edge of the impulse. When the heater is idle, positive impulse given to the input cancels the timer start of the heater, programmed in the CIP.

Table 1

X1 pin number	Signal Name	Polarity	Wire colour
1	Heater_off+	+	White
2	Heater_off-	-	Grey
3	Heater_on+	+	Green
4	Heater_on-	-	Blue
5	Button	-	Brown
6	Ventilation	+	Orange
7	RC_in	+	Yellow
8	*Ground*		*Black*
9	*Battery Power*		*Red*

The signals to be necessarily connected are marked in the table in Italics

Table 2

X2 pin number	Signal Name	Polarity	Wire colour	Maximum Electric Load*, mA
1	Status_Plus	+	Blue-white	500
2	Status_Minus	-	Yellow	500
3	Alert_1	-	Grey	500
4	Alert_2	-	Orange	500
5	Timer_out	-	Blue	500
6	Indication	+	Red-white	1000
7	Sensor_In	-	Green-yellow	
8	Sensor_Out	-	Green	500
9	*CAN-L*		*Brown-white*	
10	*CAN-H*		*Brown*	

*The connection of outputs 2-5 directly to the Power (without a load) prohibited. The connection of outputs 1 and 6 directly to the Ground (without a load) prohibited

The signals to be necessarily connected are marked in the table in Italics

X1.2 Heater_off-[1]

The input can be used to switch off the heater, operated in pre-heat mode, by the impulse of negative polarity (the input **Heater_off+** in that case has to be connected to the Power). The heater is stopped by the leading edge of the impulse. If the heater is idle, negative impulse on this input cancels the timer start of the heater, programmed by CIP. This input is suitable for the most alarm systems and GSM-modules connections in order to control the heater remotely.

X1.3 Heater_on+[1]

The input can be used to switch the heater on by the impulse of positive polarity (the input **Heater_on-** in that case has to be connected to the Ground). The heater is started by the leading edge of the impulse.

X1.4 Heater_on-[1]

The input can be used to switch the heater on by the impulse of negative polarity (the input **Heater_on+** in that case has to be connected to the Power). The heater is started by the leading edge of the impulse. This input is suitable for the most alarm systems and GSM-modules connections in order to control the heater remotely.

X1.5 Button

The input for outer button connection. The button may be used for direct start and stop of the heater

X1.6 Ventilation

The input is not used in current version

X1.7 RC_in

The input can be used to switch the heater on/off by an impulse of positive polarity. The heater is turned on by the leading edge of an impulse and is turned off by the trailing edge of the impulse. The specialized remotes such as Smart Start, Easy Start and Telestart can be connected to this input[1]. GSM-modules with a potential signal on the control channel also may be connected to the input.

X1.8 Ground [1]

X1.9 Power +12V [1]

X2.1 Status_Plus

The assignment of this output is defined by the setting 7.6. By default special signal for Defa Smart Start (settings 7.6.3) is used to inform the remote control unit

that the heater has been switched off. When the heater is switched off, the impulse of positive polarity with 0.5 second duration appears on the output. When the engine is running, the output is permanently pulled up to the Power.

X2.2 Status_Minus
The assignment of this output is defined by the setting 7.5. By default the signal "Heater operates autonomously" is given on the output.

X2.3 Alert_1
The signal is used to receive a notification to remote control (if remote is compatible to alerts receiving). The assignment of this output is defined by the setting 7.3. When programmed event is occurred, the impulse of negative polarity with 1 second duration appears on the output. By default the signal "Heater started" is given on the output.

X2.4 Alert_2
The signal is used to receive a notification to remote control (if remote is compatible to alerts receiving). The assignment of this output is defined by the setting 7.4. When programmed event is occurred, the impulse of negative polarity with 1 second duration appears on the output. By default the signal "Heater stopped" is given on the output.

X2.5 Timer_out
The output can be used to control an external device by time of the heater operation. Time of signal appearing is defined by the setting 5.1. When the heater operates programmed time, the impulse of negative polarity with 1 second duration appears on the output.

X2.6 Indication
The output can be used for connection of outer stand alone or button embedded indicator. LEDs should be connected with current limiting resistor only.

X2.7 Sensor_In
Not used

X2.8 Sensor_Out
Not used

X2.9 CAN-L
Low-level CAN bus line has to be connected to the violet-green wire of CAN bus[1].

X2.10 CAN-H
High-level CAN bus line has to be connected to the violet-white wire of CAN bus[1].

[1]- See installation manual for connection details

Connection

Permanent connection to the car's wiring is required. See installation manual for detailed connection schemes for various remotes.

RCP needs that timers and direct start / stop function for the heater control are present in the CIP. Therefore it may be necessary to load the special software to the CIP at first, by the means of Volvo dealer's equipment.

Troubleshooting

If a run-time error occurs during the heater operation, RCP informs about error code with embedded LED flashing. The number of flashes in series corresponds to the error code. See table 4 for errors description and possible solutions.

Table 4

Error Code	Error Description	Possible Reasons of Error Appearance	Solutions
2	No answer from the heater followed the start command	Outer temperature displayed by the CIP is higher than +14 Celsius degrees	The heater operates only at temperatures below +15°C. It is heater manufacturer restriction
		Fuel level in the fuel tank is close to empty ("Fuel Low" warning indicator is illuminated in the CIP)	Refuel the car
		The heater was blocked after 3 unsuccessful starts	Try to start the heater in the CIP menu. If it doesn't start up, make diagnostics of the heater.
3	Battery low	The module has determined that the battery voltage is below the specified by settings items 3.1 or 3.2	Charge car's battery with special charger (or start engine to charge) or cancel 3.1/3.2 module's settings
4	Time limits exceeded	Time limit for autonomous operation of the heater is achieved (with applied setting 1.1)	Run the engine or cancel applied setting

5	Unsuccessful start	The heater was switched off spontaneously at startup	Make diagnostics of the heater if the error appears again
6	Operation cycle too short	The heater was switched off spontaneously	Make diagnostics of the heater if the error appears again
8	CAN-bus error	There is a problem with module connection to the CAN-bus	Check for the connection
9	Settings error	Settings have been stored in RCP's memory incorrectly	Reset the settings (8.1.1), readjust the module
11	Heater no connection	The heater is unplugged or out of order	Make diagnostics of the heater

Glossary

CAN - Control Area Network (digital network for data transfer in vehicles)
RCP - Remote Control Plug-in (electronic module for the heater remote control)
CIP - Combined Instrument Panel