Autoplugin RCP-F2

Version 7.2

Technical Description
User Manual

Rev. B

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Description

The **Autoplugin RCP-F2** module is intended for remote control connection to the fuel-fired heater (parking heater, fuel operated heater, pre-heater), factory installed in **Ford Focus 2** (2004-2011), **Ford C-Max** (2003-2010) or **Ford Kuga** (2008-2012). The device controls the heater via CAN-bus.

Module Possibilities

- Heater control by various impulses
- Heater status signals outputs
- Embedded remote control of the heater by using the original 3-button Ford vehicle's key
- Remote cancellation of the heater startup, programmed in driver information system
- Indication of successful/unsuccessful start and of autonomous operation of the heater by direction indicators in rear-view mirrors.
- Extended boost heat mode control
- Main battery protection from discharging by inspection of voltage level and time of autonomous operation of the heater
- Heater errors clearing (unblocking)

Package Content

1. Autoplugin RCP-F2 (0101-1110) module
2. Wiring for permanent connection
3. Plug-n-Play cable
4. Technical description brochure
5. Installation manual brochure

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 first pin on each connector 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, by 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. If the heater is idle, positive impulse on this input cancels the program start of the heater, programmed by DIS.

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	Boost	+	Orange
7	RC_in	+	Yellow
8	*Ground*		*Black*
9	*Battery Power*		*Red*

The signals to be necessarily connected marked in Italics

Table 2

X2 pin number	Signal Name	Polarity	Wire colour	Maximum Electric Load*, mA
1	RC_out	+	Blue-white	500
2	Heater_Status	-	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, is not permitted. The connection of outputs 1 and 6 directly to the Ground, without a load, is not permitted
The signals to be necessarily connected marked in Italics

X1.2 Heater_off-[1]
The input can be used to switch the heater off, 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 program start of the heater, programmed by DIS. 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 multi-functional button connection. The current function of the button depends on the heater status, the ignition status and the engine status (see Table 4 for more details)
X1.6 Boost
The input for external control of the boost heat mode. It enables or disables the boost heat mode depending on the module setting 1.1. External switch can be connected to the Boost input in order to quick manage of the boost heat mode.
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 RC_out
The output is used to inform Defa VU module 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. This signal is used for Defa Smart Start only.

X2.2 Status
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 send a notification to remote control (RC should be capable to receive alerts). 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 send a notification to remote control (RC should be capable to receive alerts). 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 stand alone or button built-in indicator, which will inform you about heater run-time errors.
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 blue wire of Medium Speed CAN bus[1].
X2.10 CAN-H
High-level CAN bus line has to be connected to the grey wire of Medium Speed CAN bus[1].

[1]- See installation manual for connection details

Connection

RCP gives a possibility of quick connection to the OBD-II service connector by using supplied Plug-n-Play cable. Professional installation is recommended for connection of additional remote control. It needs at least some experience in car electronics installation. See installation manual for detailed connection schemes for various remotes.

Preparation for Work

- Focus II (2004-2007), C-Max (2003-2006)

Turn on the ignition and select in driver information system (DIS) menu:
Your settings -> Aux.heater programming ->Instant control -> Auto

- Focus II (2008-2011), C-Max (2007-2010), Kuga

Start the engine and select in DIS menu:
Set>Menu –> Settings –> Auxiliary Heating -> On ->Off ->On (again)

Basic Functions

1. To start/stop the heater by using additional remote control, see documentation for the remote control. Functionality of the remote control depends on its possibilities, connection schemes and module's settings.
2. To start the heater by using the original Ford key press "Lock" button 3 times on the key. Time intervals between presses must not exceed 20 seconds. The unlocking of the vehicle or time interval excess will restart the counter of "Lock" button presses. Look at the direction indicators to be sure that RCP has received a command from the key. Every button press on the key will be confirmed by the turn signals (if the car has been locked before). Also if the car equipped by keyless entry system, you can use button on the door handle as "Lock" button to start the heater outside the vehicle (passive key must be presented). You can see series of double flashes in direction indicators of rear-view mirrors when the heater starts to operate (choose setting 6.1.2 to activate this function).
3. The RCP adjusted by default only to switch the heater on by Ford key. If you also wish to switch the heater off, change the setting 5.1. As both the commands use the same combination of "Lock" presses, you should know a condition of the heater before a command send. Therefore we recommend you to activate the settings 6.4 – 6.6 to see the heater condition indicated by turn signals flashing in the rear-view mirrors. The possibility to stop the heater remotely may be useful in case of cancelation of the trip, including ones programmed by DIS.
4. You can remotely cancel the start of the heater by a DIS program, if your additional remote control can send stop command when the heater is idle. After stop command sending, DIS programs will be temporary disabled. Start the heater by any way or turn the ignition on enables DIS programs again.
5. Additionally connected button has several functions. Current function is defined by the heater condition, the ignition condition and the engine condition (see table. 3)

When the ignition is turned off, the button is used for immediate start or stop of the heater. Button press changes a heater condition to another one: switches off the operated heater or switches on the idle heater.

When the ignition is turned on, button press keeps the current condition of the heater after the engine start. So, if the heater has operated before the engine start, it may continue to operate after the engine start (in boost heat mode). If the heater has been idle before the engine start, button press will inform RCP doesn't let the heater to start in boost heat mode after the engine start. These functions are called quick enabling and disabling of boost heat mode respectively. Being activated these functions act for the current ignition cycle. Turning the ignition off cancels these functions.

Table 3

Button function	Ignition status	Engine status	Heater status	Description (how to use)
Heater immediate start	Off	Not running	Off	One-touch heater start
Heater immediate stop	Off	Not running	On	One-touch heater stop
One-time boost disable	On	Not running	Off	Quick disabling of boost heat mode for short trips
One-time boost enable	On	Not running	On	Quick enabling of boost heat mode in the case of boost heat mode disabling by RCP settings or in the case of one-time disabling previously
	On	Running	Off	
Boost extension	On	Running	On	This function lets the heater keep working after the engine has been switched off. It is useful with short stops in a trip.

When the engine runs, the button press is used to quickly enable of the boost heat mode (if boost heat mode was disabled early) and for the function called Boost Extension (if the heater operates in boost heat mode). Usually the heater is turned off right after the engine stops. If you want stop the engine with the heater keep working, you may use this button function. Boost extension once activated will act while don't you stop the heater manually or the heater stops automatically when the coolant achieves working temperature.
Warning! The parking heater must not be operated at filling stations, near sources of combustible vapours or dust or in enclosed spaces

The fuel fired heater needs about 3 minutes to go to the normal operation after the startup. If your trip is planned to be shorter, it is highly recommended to use a button function called "one-time boost disable". This preserves the heater from premature clogging. Turn on the ignition, press the button, then

start the engine. Now the heater will not operate with the engine while don't you turn the ignition off or use "one-time boost enable" function.

Additional Functions

By default RCP adjusted to perform only the basic functions, such as start and stop the heater using the remote control key. To turn on additional functions such as battery monitoring, flashing with direction indicators in rearview mirrors, etc. enter the module into Setup mode and activate the corresponding setup item (see settings table 2).

A programming button and the brakes pedal are used to enter setup mode and to the settings change. You can use either additionally installed button, or front passenger's window close button on the driver's door control panel as programming button. Some car versions not allow using power window control button as programming button. Use additional button in that case.

It is necessary to stop the engine and the heater before. Turn the ignition on, press and hold the brakes pedal. Then 3 times press the programming button (press and hold additional button until LED goes off, about 1.5 seconds). Both direction indicators in the DIS confirm entering to the setup mode with 2 flashes. Release the brakes pedal finally.

Each setup item in the settings table is a 3-digit code. To enter a digit of a code, shortly press the button so much times, as corresponds to a digit. The LED and the direction indicators symbols in the DIS confirm each button press: the LED briefly goes off, the left direction indicator flashes one time when the first or the third digit of code entered, the right direction indicator - when the second digit of code entered. To complete a digit entering, press and release brakes pedal. The DIS confirms it with one flash of both direction indicators simultaneously. When all three digits entered, the module checks the code for validity and confirms it with the direction indicators flashing. The both direction indicators flash twice simultaneously in case of valid code and flash twice alternately in case of invalid code.

If entered digit is not correct, press and release brakes button until the module indicates an error. 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 the nonvolatile memory of the module and stored there regardless of whether the module is connected or not. **Attention:** If you start the engine without exit Setup mode, new settings will not be saved in memory.

To reset the module to the factory settings, enter the code 8.1.1. Both direction indicators in the CIP should flash three times, confirming command execution. Then the module exits Setup mode and restarts.

To clear all the errors in the heater's memory and thus unblock the heater, enter the code 9.1.1. Both direction indicators flash five times confirming errors clearing. If

unblocking of the heater is impossible, the indicators flash five times alternatively. **Pay attention**: when you apply unblocking function for the first time, RCP remembers VIN code of the car. In the future unblock function will work only for this car.

Settings Table (4)

1. Boost Heat Mode Control	**1.1.** Additional engine heating in the boost heat mode	**1.1.1** *Enabled by the module. Active level on X1.6 will disable the boost heat mode **1.1.2** Disabled by the module. Active level on X1.6 will enable the boost heat mode **1.1.3** Disabled by the module permanently **1.1.4** Disabled all the time, except in the case of the heater has operated before the engine start
	1.2. Additional engine heating disable by coolant temperature (in Celsius degrees)	**1.2.1** *Not applied **1.2.2** Higher than 0 degrees **1.2.3** Higher than +10 degrees **1.2.4** Higher than +20 degrees **1.2.5** Higher than +30 degrees **1.2.6** Higher than +40 degrees ***1.2.7*** *Higher than +50 degrees* **1.2.8** Higher than +60 degrees **1.2.9** Higher than +65 degrees **1.2.10** Higher than +70 degrees
2. Heater Timing	**2.1.** Limitation of the heater total operation time in pre-heat mode	**2.1.1** Not adjusted **2.1.2** 40 minutes **2.1.3** 50 minutes **2.1.4** 60 minutes **2.1.5** **70 minutes* **2.1.6** 80 minutes **2.1.7** 90 minutes **2.1.8** 100 minutes **2.1.9** 120 minutes
	2.2. Limitation of the heater cycle operation time in pre-heat mode	**2.2.1** 10 minutes **2.2.2** 15 minutes **2.2.3** 20 minutes **2.2.4** 25 minutes **2.2.5** 30 minutes **2.2.6** 40 minutes **2.2.7** 50 minutes **2.2.8** 60 minutes **2.2.9** **70 minutes*
3. Heater Operation	**3.1.** Heater operation mode for remote	**3.1.1** Immediate start, automatic stop in 30 minutes **3.1.2** * Immediate start, automatic stop in 30

Mode	start by Ford key and by the input line "Heater_on"	– 70 minutes (when engine coolant will completely warmed) **3.1.3** Higher than -12˚C - mode 3.1.2, below -12˚C – delayed start with startup in 2 minutes[1] and automatic stop in 70 minutes
	3.2. Heater operation mode for remote start the input line "RC_in"	**3.2.1** Immediate start, automatic stop in 30 minutes. The mode is suitable for remotes with start programs. **3.2.2** * Immediate start, automatic stop in 30 – 70 minutes (when engine coolant will completely warmed) **3.2.3** Delayed start with startup in 2 – 40 minutes and automatic stop in 70 minutes. The mode is for the start by a program of RC mainly
	3.3. "Lock" button's function for the heater remote control	**3.3.1** *Heater start only **3.3.2 S**tart of idle heater, stop of operated heater
	3.4. "Lock" button presses count to activate the RCP module	**3.4.1** Heater control by Ford key is disabled **3.4.2** Two presses **3.4.3** Three presses **3.4.4** **Four presses* **3.4.5** Five presses **3.4.6** Six presses
4. Battery Monitoring	**4.1.** Minimal voltage to let the heater start in pre-heat mode	**4.1.1** * Not adjusted **4.1.2** 11.4V **4.1.3** 11.6V **4.1.4** 11.8V **4.1.5** *12.0V* **4.1.6** 12.1V **4.1.7** 12.2V **4.1.8** 12.3V **4.1.9** 12.4V
	4.2. Minimal voltage to keep operating the heater for pre-heat mode [2]	**4.2.1** * Not adjusted **4.2.2** 10.6V **4.2.3** 10.8V **4.2.4** 11.0V **4.2.5** 11.2V **4.2.6** *11.4V* **4.2.7** 11.5V **4.2.8** 11.6V **4.2.9** 11.7 V
5. Timer Out	**5.1.** Activate the Timer_Out line by	**5.1.1** *Don't activate **5.1.2** In 10 minutes after the heater startup

Control	the time of the heater autonomous operation	**5.1.3** In 15 minutes after the heater startup **5.1.4** In 20 minutes after the heater startup **5.1.5** In 25 minutes after the heater startup **5.1.6** In 30 minutes after the heater startup **5.1.7** In 40 minutes after the heater startup **5.1.8** In 50 minutes after the heater startup **5.1.9** In 60 minutes after the heater startup
	5.4. Activate the Timer_Out line directly by the start command resend via the "Heater_On" line	**5.4.1** *Off **5.4.2** On
6. Heater startup and operation mode indication by the turn signals in the rear-view mirrors and in the DIS	**6.1.** Indication of successful startup of the heater from remote control	**6.1.1** *Off **6.1.2** Series of double flashes
	6.2. Indication of unsuccessful startup of the heater from remote control	**6.2.1** *Off **6.2.2** Series of single flashes
	6.3. Indication of the operated heater, started by remote control	**6.3.1** *Off **6.3.2** On
	6.4. Indication of the operated heater, started by DIS (direct or program start)	**6.4.1** *Off **6.4.2** On
	6.5. Indication of the operated heater, started by button	**6.5.1** *Off **6.5.2** On
	6.7. Flashing frequency for indication of heater autonomous operation	**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
	6.8. Button press confirmation[3]	**6.8.1** *Off **6.8.2** One-time flash

7. Output signals adjustment	**7.3.** Notification signals on the output "Alert_1" [4]	**7.3.1** *"Heater started" **7.3.2** "Heater stopped" **7.3.5** "Heater started to burn" **7.3.6** "Heating finished **7.3.7** "Error occured" **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" **7.4.6** "Heating finished **7.4.7** "Error occured" **7.4.8** Disable the output
	7.5. Signals on the output "Status"	**7.5.1** Heater operates (potential) **7.5.2** *Heater operates autonomously (from battery, engine is off) (potential) **7.5.3** Heater operates autonomously (double impulses with the frequency adjusted by 6.7, applying settings 6.3-6.5)[5] **7.5.4** Engine runs (potential) **7.5.5** Engine runs (RPM impulses) **7.5.6.** Ventilation is on during the heater operation (potential) **7.5.7.** Ventilation is off during the heater operation (potential) **7.5.8.** Disable the output
8. Settings reset		**8.1.1** Apply factory settings
9. Heater errors reset[4]		**9.1.1** Clear all errors in heater's memory, resulting heater unblocking

* Factory setting
Recommended settings marked in Italics

[1] –Not recommended for vehicles released after 2008 year because the heater startup is not guaranteed in 2 minutes. Using 3.1.3 mode you can save battery energy at low temperatures, because the heater switches on cabin ventilation not immediately after start, but after the coolant warms up to +30˚C.
[2] –RCP turns off the heater if the battery voltage becomes lower than preset
[3] – Setting is not recommended for vehicles equipped with direction indicators in rear-view mirrors.
[4] – Signals appear only during the heater's autonomous operation

[5] – Signal is used for indication by the all hazard flashers. It uses 1-wire connection to the hazard alarm button (see installation manual for details). Indication by the turn signals via CAN-bus is switched off

Troubleshooting

If a run-time error occurs at the start of the heater, RCP informs user with the built-in and an additional LEDs blinking about the error code. The number of flashes corresponds to the error code. See table 5 for the codes description and possible solutions.

Table 5

Error Code	Error Description	Possible Reasons of Error Appearance	Solutions
1	Start command cannot be executed	The heater is not adjusted in DIS menu (or has been reset to unadjusted condition after battery discharging or disconnection)	See chapter **Preparation for Work** to adjust the heater
2	No answer from the heater followed the start command	The engine is hot (no need to pre-heat)	Let the engine cool down below +75 degrees
		The heater hasn't finished previous operation cycle yet (you can hear the noise from the air blower fan)	The heater starts when previous cycle of operation is fully completed
		Fuel level in the tank is close to empty ("Fuel Low" warning indicator is lighting in DIS)	Refuel the car
		The heater is blocked after 5 unsuccessful starts	Try to start the heater from DIS menu. If it doesn't start to burn, check for fuel and coolant quality (especially at extreme cold temperatures) and possible heater's exhaust system clogging by snow. Then unblock the heater using setup mode (command 9.1.1).

3	Battery low	The module has determined that the battery voltage at the heater startup or during the heater operation is lower than specified in the settings 4.1 и 4.2	Charge car's battery with special charger (or start engine to charge) or cancel 4.1/4.2 module's settings
4	Time limits exceeded	Time limit for autonomous operation of the heater is achieved (with active setting 2.1)	Run the engine or cancel 2.1 module's setting
5	Unsuccessful start	The heater was switched off spontaneously at a startup	Make diagnostics of the heater if the error occurs again
6	Operation cycle too short	The heater was switched off spontaneously with operating time of less than 20 minutes	Make diagnostics of the heater if the error occurs again
8	CAN-bus error	There is a problem with connection of the module to the CAN-bus	Check the module's connection
9	Settings error	Settings have been incorrectly stored in RCP memory	Reset the settings (8.1.1), readjust RCP
11	Heater no connection	The heater is unplugged from CAN-bus or is 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)
DIS - Driver Information System of the instrument cluster
BHM or Boost Heat Mode – operational mode of the heater, when it operates together with the engine to help the engine and the interior warm up more quickly

