ifm electronic

CE

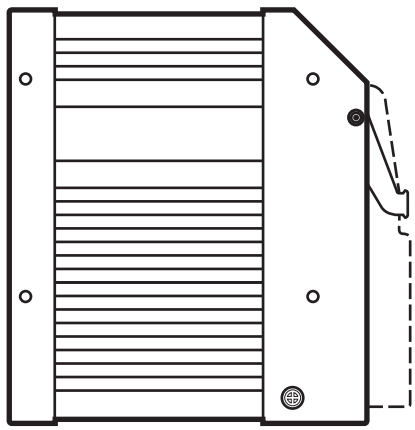
Brief instructions

R360 starter set with SmartController CR2500 and CoDeSys 2.3

UK

ecomat100®

EC2074



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Contents

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1 Preliminary note

This document applies to devices of the "R360 starter set" (art. no.: EC2074).

Read this document before use to familiarise yourself with operating conditions, installation and operation. Keep this document during the entire duration of use of the device.

Adhere to the safety instructions.

1.1 Symbols used

► Instruction
> Reaction, result
[…] Designation of pushbuttons, buttons or indications
→ Cross-reference

Important note
Non-compliance can result in malfunctions or interference.

Information
Supplementary note

1.2 Warning signs used

NOTE

Warning of damage to property.

2 Safety instructions

2.1 General

These instructions are part of the device. It contains information and illustrations about the correct handling of the device and must be read before installation or use.

Observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can seriously affect the safety of people and machinery.

Adhere to the supplied "Installation and safety instructions SmartController CR2500".

2.2 Target group

These instructions are intended for authorised persons according to the EMC and low-voltage directives.

2.3 Electrical connection

To avoid risks for persons and material, voltage supply of the device must be made using the supplied power supply.

All statements in these instructions refer to the device operated with the supplied power supply and the prewired connection cable.

The connection terminals may only be supplied with the signals indicated in the technical data and/or on the device label and only the approved accessories of ifm electronic may be connected.

2.4 Housing temperature

According to the technical specifications below the device can be operated in a wide operating temperature range. Because of the additional internal heating the housing walls can have high perceptible temperatures when touched in hot environments.

2.5 Tampering with the device

In case of malfunctions or uncertainties please contact the manufacturer. Tampering with the device can seriously affect the safety of operators and machinery. It is not permitted and leads to the exclusion of any liability and warranty claims.

2.6 Electromagnetic compatibility

This is a class A installation. It can cause radio interference in domestic areas. In this case the operator is requested to take appropriate measures.

3 Items supplied

- Controller SmartController (art. no.: CR2500)
- I/O simulator box incl. prewired connection cable
  – 1 x 55-pole AMP connector, lock function and reverse-polarity protection
  – 1 x 9-pole RS-232 D-SUB connector, socket
  – 1 x 2-pole connector (voltage supply)
  – 2 x 5-pole socket, M12 (CAN bus 1 and 2)
- Plug-in power supply, 230 V, 50 Hz / 24 V DC, 1000 mA
- CD-ROM
  – Programming software CoDeSys V2.3
  – Demo programs, libraries and tools
  – E-learning
  – Manual for the program development CoDeSys V2.3 (PDF)
  – System manual controller family R360 (PDF)
- Installation instructions SmartController CR2500
- Brief instructions R360 starter set (this document)

4 System requirements

4.1 Hardware

- Pentium III processor (or higher)
- 512 MB RAM memory (or higher)
- 50 MB free hard disk memory
- CD-ROM drive
- 1 free serial interface (RS-232)
- Screen resolution 1024 x 768
- 32-bit colour depth (recommended)

4.2 Software

- Microsoft Windows XP® (SP1)
- Adobe Flash 8.0

5 Functions and features

5.1 General

The starter set for the ifm control system R360 serves as an introduction into the programming system CoDeSys V2.3.
All components are very easy to install. All required connections are prewired.

NOTE

Use in conjunction with controllers from other manufacturers can lead to destruction of the controller or the I/O simulator box.
► The prewired connection cable may only be used with the supplied controller.

5.2 Components of the starter set

5.2.1 Controller SmartController CR2500

The freely programmable controllers of the series R360 have been specifically developed for use in vehicles and mobile applications.
In conjunction with the other components of the control system R360 they are used to control and monitor these mobile machines.
As opposed to conventional industrial controllers for use in protected control cabinets, the controllers R360 comply with the extreme requirements in this area.

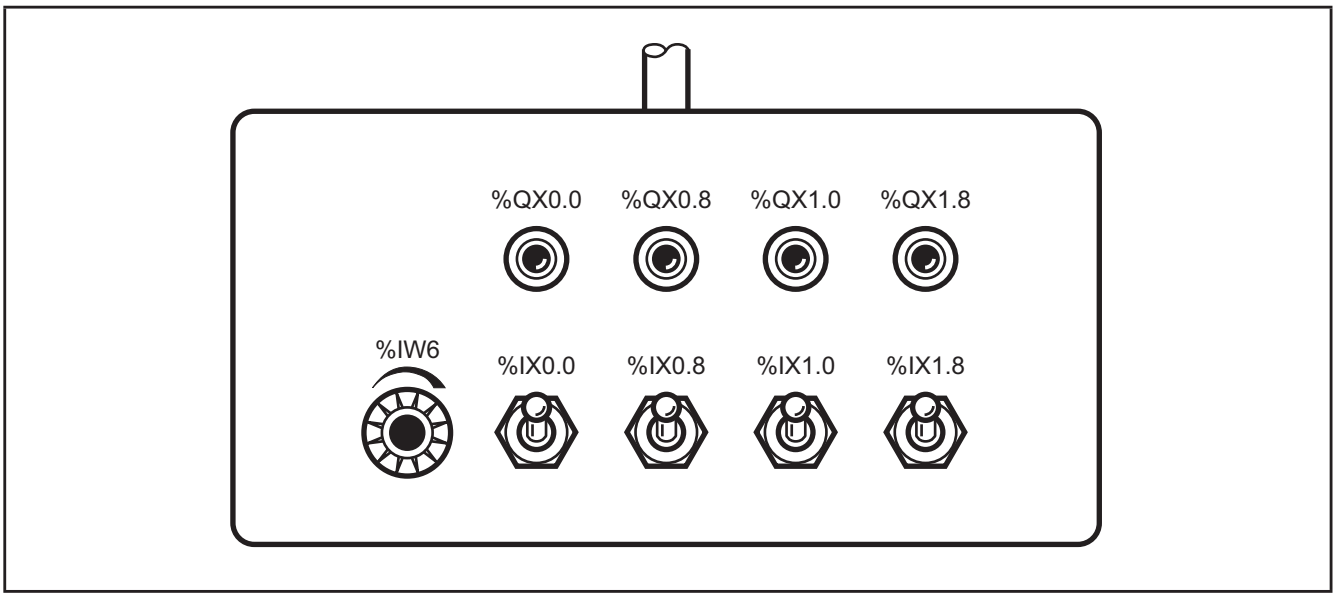
Features at a glance

- Mechanical resistance to extreme shocks
- High protection rating IP 67 for outdoor use
- Powerful 16-bit microcontrollers for short cycle times
- Increased functional reliability due to permanent checksum test of the program and the system
- 8-bit parallel processor for monitoring the main processor (C 167 C)
- Load-dump resistance
- Output monitoring for wire break and short circuit
- 8 inputs (4 digital, incl. 2 pulse inputs max. 50 kHz/4 analogue)
- 4 outputs (digital/PWM/current-controlled)
- Monitoring and measurement of the supply voltage and the device temperature
- Serial RS-232 interface for program download and communication
- 1st CAN interface with CANopen protocol and free protocol (layer 2) for program download and communication
- 2nd CAN interface for gateway function according to SAE J 1939
- Free programming according to IEC 61131-3 with the standard languages
  - function block diagram (FBD)
  - ladder diagram (LD)
  - instruction list (IL)
  - sequential function chart (SFC)
  - structured text (ST)

5.2.2 I/O simulator box

To test the supplied or self-created project applications the I/O simulator box features display and operating elements.

- 4 miniature toggle switches to simulate digital inputs (on / off / momentary on)
- 1 potentiometer, 10 kW linear to simulate the analogue input
- 4 yellow lamps to simulate the outputs



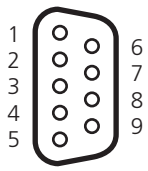
I/O simulator box

The inputs (switches and potentiometer) or outputs (lamps) are identified with the IEC 61131 addresses.

Assignment	IEC address	Connection controller
Switch	%IX0.0	40 (binary inputs low side)
	%IX0.8	41
	%IX1.0	52
	%IX1.8	53
Lamp	%QX0.0	38 (binary outputs high side)
	%QX0.8	39
	%QX1.0	54
	%QX1.8	55
Potentiometer	%IW6	46 (analogue input low side)

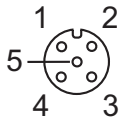
5.2.3 Interfaces

For programming, diagnosis and communication three interfaces are available.



Pin	Potential
1	n.c.
2	TxD
3	RxD
4	n.c.
5	GND
6	n.c.
7	n.c.
8	n.c.
9	n.c.

RS-232 (1x)



Pin	Potential
1	GND
2	VBB
3	GND
4	CAN_H
5	CAN_L

CAN bus (2x)

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The serial RS-232 interface is used for connection to the programming PC.

For the connection of other CAN components the CAN 1 interface has been brought out of the 55-pole AMP connector. According to the valid specifications it can be used simultaneously by several CAN participants, for example I/O modules, displays, inclination sensors, etc.

The CAN 2 interface also enables the connection of SAE j 1939 components.

5.2.4 Voltage supply

The voltage supply for the controller, the I/O simulator box and other CAN components is provided via the 2-pole connector and the plug-in power supply.

The plug-in power supply of the starter set supplies 24 V DC, 1000 mA. Since all connected CAN components are supplied via the plug-in power supply, adhere to the max. total current when the system is expanded.

5.2.5 Programming software CoDeSys

CoDeSys is a complete development environment for R360 controllers. With this environment the PLC programmer can conveniently use the programming languages to IEC 61131-3.

Functions and features of CoDeSys:

- Programming of the controller according to the standard IEC 61131-3 (FBD, LD, IL, SFC and ST)
- Visualisation and diagnosis of the available controller data
- Setting of all communication parameters of the connected controller hardware
- Convenient editors conforming to Windows representation
- Extensive debugging, test and diagnostic tools
- Program simulation online / offline
- Detailed documentation and online help
- Exchange of data with other Windows programs via DDE interface

5.2.6 E-learning

The e-learning on the supplied CD-ROM explains the set-up and the first steps using the example of a CR2500 controller.
It is an independent training for programming an ecomat R360 controller and is based on the starter set EC2074.

5.2.7 Demo programs

The CD-ROM contains demo programs to provide the user with a comprehensible overview of selected functions.
These demo programs are automatically copied to the hard disk during the installation of CoDeSys (→ 6.3.2 Directories on the PC).
The demo programs are started directly from the programming surface of the CoDeSys program.

5.2.8 Tools

The CD-ROM contains software tools for installation and updates of the operating system as well as for CAN bus analysis and protocolling.

5.2.9 Documentation

For more details, manuals concerning the R360 controller and the programming software CoDeSys are stored on the CD-ROM.
They are in PDF format and can be read or printed by means of the program Adobe Reader.®.

The Adobe Reader® can be downloaded free of charge at www.adobe.com.

6 Set-up

6.1 Set-up with e-learning

Contents of the e-learning:

- Set-up of the hardware
- Software installation and establishment of the connection
- Program demonstration
- Extension of the program code
- Own projects
- Outlook
- Quiz

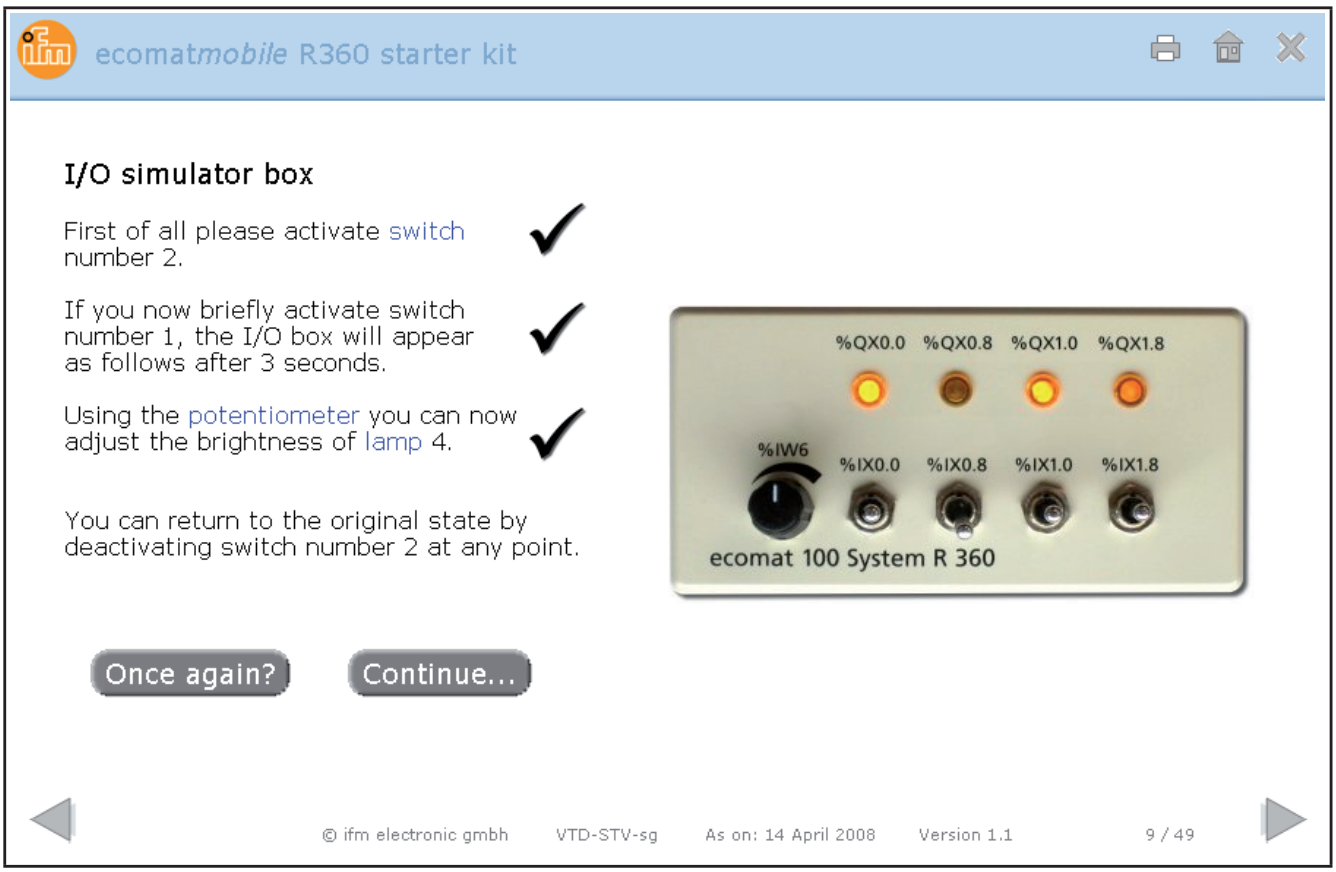
Starting the e-learning:

► Start Windows and insert the CD-ROM in the CD drive.
> If the autostart function of the CD drive is active, the selection menu of the CD is displayed after a short intro.
(If the autostart function is deactivated, start the file "ifmCDStart.exe" in the main directory of the CD).

► Select [e-learning] and click the start button in the following window.
> The start screen of the e-learning is opened.

Start screen e-learning

► Go through the e-learning step by step and follow the instructions.



Example: I/O simulator box

6.2 Set-up without e-learning

6.2.1 Hardware installation

► Connect the 55-pole AMP connector to the controller. Adhere to the order of the steps A/B/C shown in the schematic drawing.

A: Place the AMP connector into the guide slot of the controller.
B: Swivel the AMP connector onto the connector of the controller. The guide slot fixes the AMP connector and serves as a pivot.
C: Place the locking clip over the AMP connector. The locking clip presses the AMP connector onto the connector of the controller.

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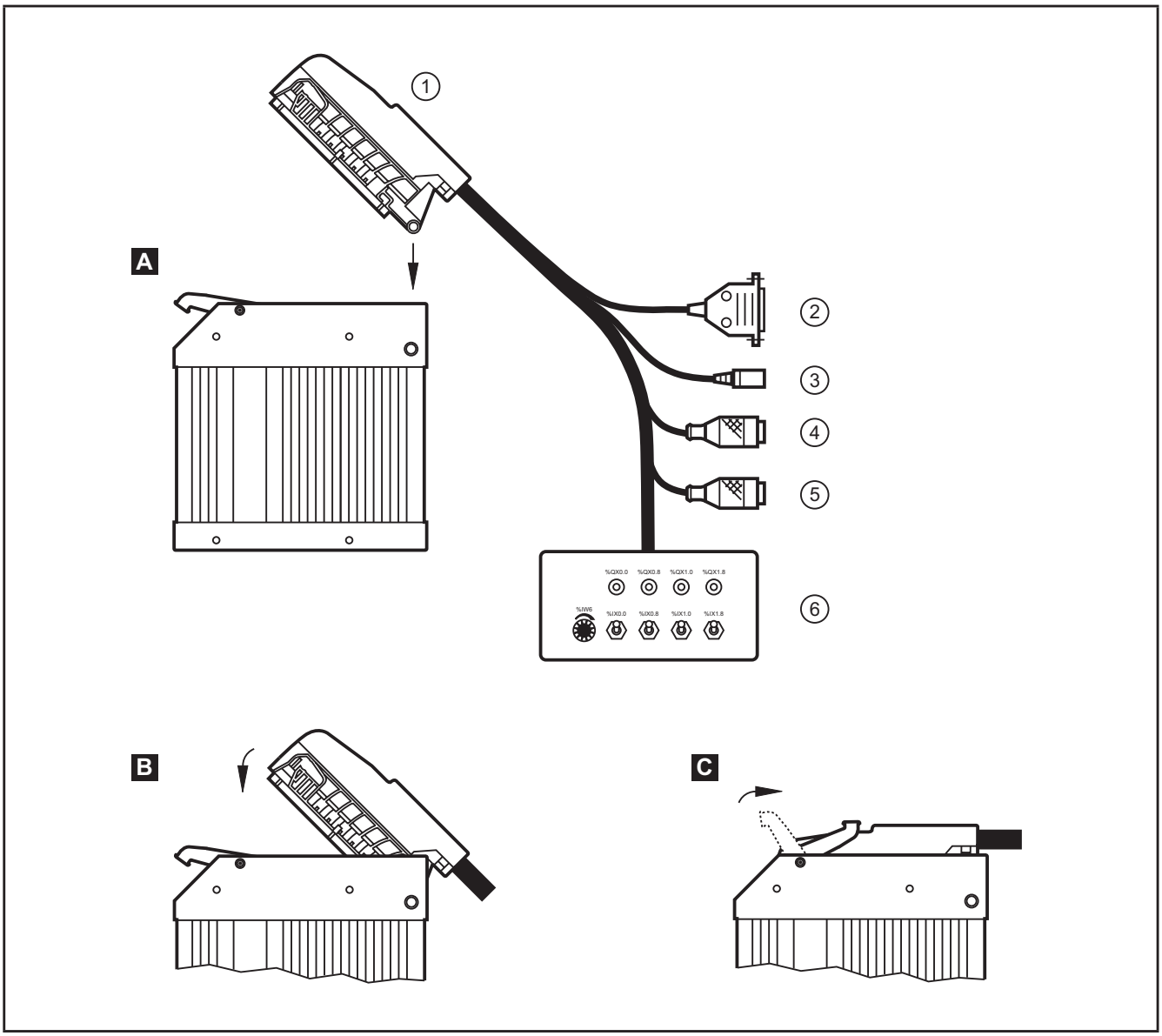
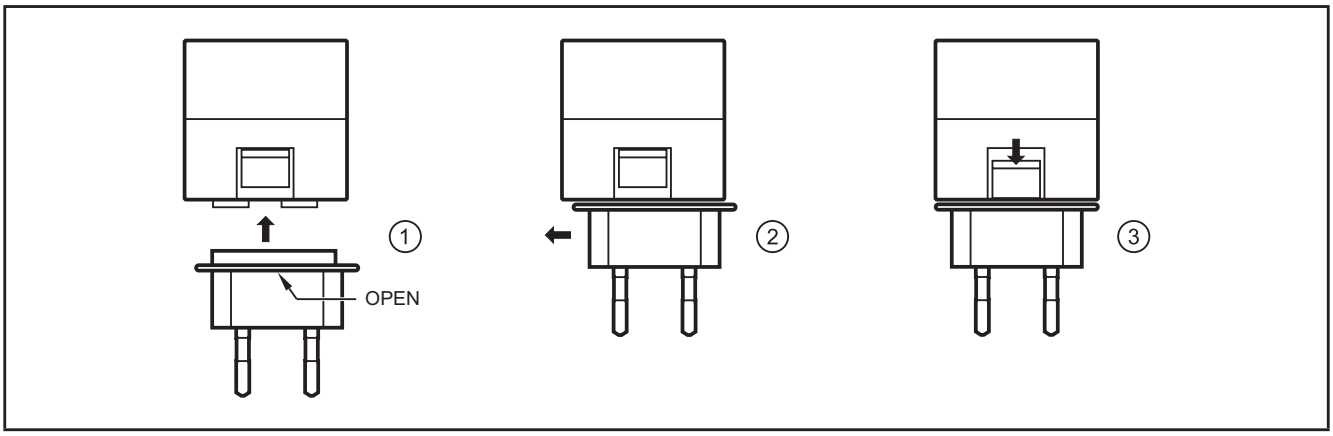


1: 55-pole AMP connector (controller)
2: 9-pole RS-232 D-SUB connector (PC)
3: 2-pole connector (voltage supply)
4: 5-pole socket M12 (CAN bus 1)
5: 5-pole socket M12 (CAN bus 2)
6: I/O simulator box

► Insert the 9-pole RS-232 D-SUB connector into the free serial interface of the PC.

► Connect the 2-pole connector to the plug-in power supply.

► Insert the plug-in power supply into the wall socket (230 V, 50 Hz).
First attach the country-specific mains adapter, if necessary.



Attaching the mains adapters

1: Place the mains adapter onto the power supply so that it is a slightly shifted.
(The text "OPEN" on the mains adapter is at the top.)
2: Snap the mains adapter in place so that it is centered to the power supply.
3: Slide the lock to the front.

The mains adapter is removed in reverse order.

The 5-pole sockets CAN bus 1 and CAN bus 2 are for the connection of further CAN components and remain unconnected.

6.3 Overview software

6.3.1 Installation of CoDeSys and downloader

► Start Windows and insert the CD-ROM in the CD drive.
> If the autostart function of the CD drive is active, the selection menu of the CD is displayed after a short intro.
(If the autostart function is deactivated, start the file "ifmCDStart.exe" in the main directory of the CD).

CoDeSys	Programming software → Version 2.3 → CoDeSys (D / E)
Downloader	ecolog tools → Downloader

6.3.2 Directories on the PC

CoDeSys	C:\<Program Files>\ifm electronic\CoDeSys V2.3\	
→	Operating system *.h86:	…\Targets\ifm\Library\ifm_CR2500\ifm_CR2500_V040002.h86
→	Configuration files *.cfg:	…\Targets\ifm\ifm_CR2500cfg\V040002\ifm_CR2500_V040002.cfg
→	Libraries (ifm) *.lib:	…\Targets\ifm\Library\
→	Libraries (3S) *.lib:	…\Library\
→	Templates *.prj:	…\Projects\Template
→	Targets *.trg:	…\Targets\ifm

→	Demo programs *.prj:	…\Projects\DEMO_…

Do not modify the provided directory structures and names to ensure correct functioning of the supplied demo programs.

6.3.3 Register CoDeSys

POUs	PLC_PRG, programs, function blocks, functions
Data types	(blank)
Visualisations	(blank)
Resources	Library manager, controller configuration, global variables, sampling trace, target settings, etc.

6.3.4 Shortkeys CoDeSys (selection)

Online help	F1
Input assistant	F2
Login	Alt + F8
Logout	Ctrl + F8

Start	F5
Stop	Shift + F8
Write values	Ctrl + F7

6.3.5 Load the operating system into the controller

For the SmartController CR2500 of the starter set, the operating system has already been factory loaded. The following steps are not necessary.
For all other controllers of the R360 family purchased separately, this must be carried out manually.

► Install and start the software downloader.

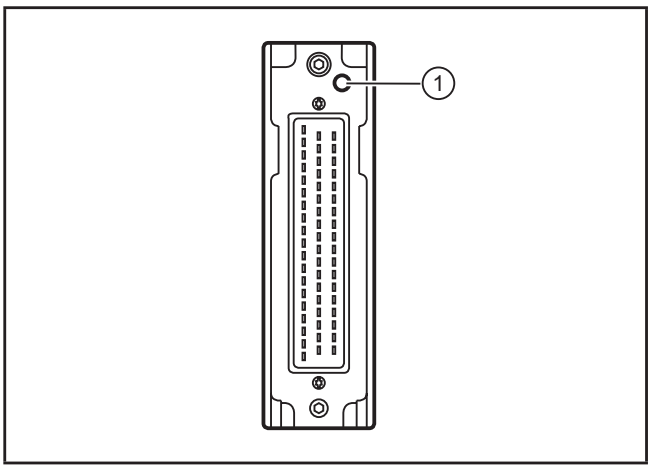
► Click on [Download] and select the operating system.

Directory	C:\<Program Files>\ifm electronic\CoDeSys V2.3\Targets\ifm\Library\ifm_CR2500
Operating system	ifm_CR2500_Vxxxxxx.h86

► Load the operating system into the controller with [Open]

7 Operation

7.1 Operation indication



1: Status LED (RGB)

7.2 Operating states

After power-on, a controller of the R360 family can be in one of 5 possible operating states.

After power-on, the SmartController CR2500 of the starter set is in the operating state "Run".
The demo program "StarterSetDemo" (shredder system) is factory installed in the SmartController of the starter set.

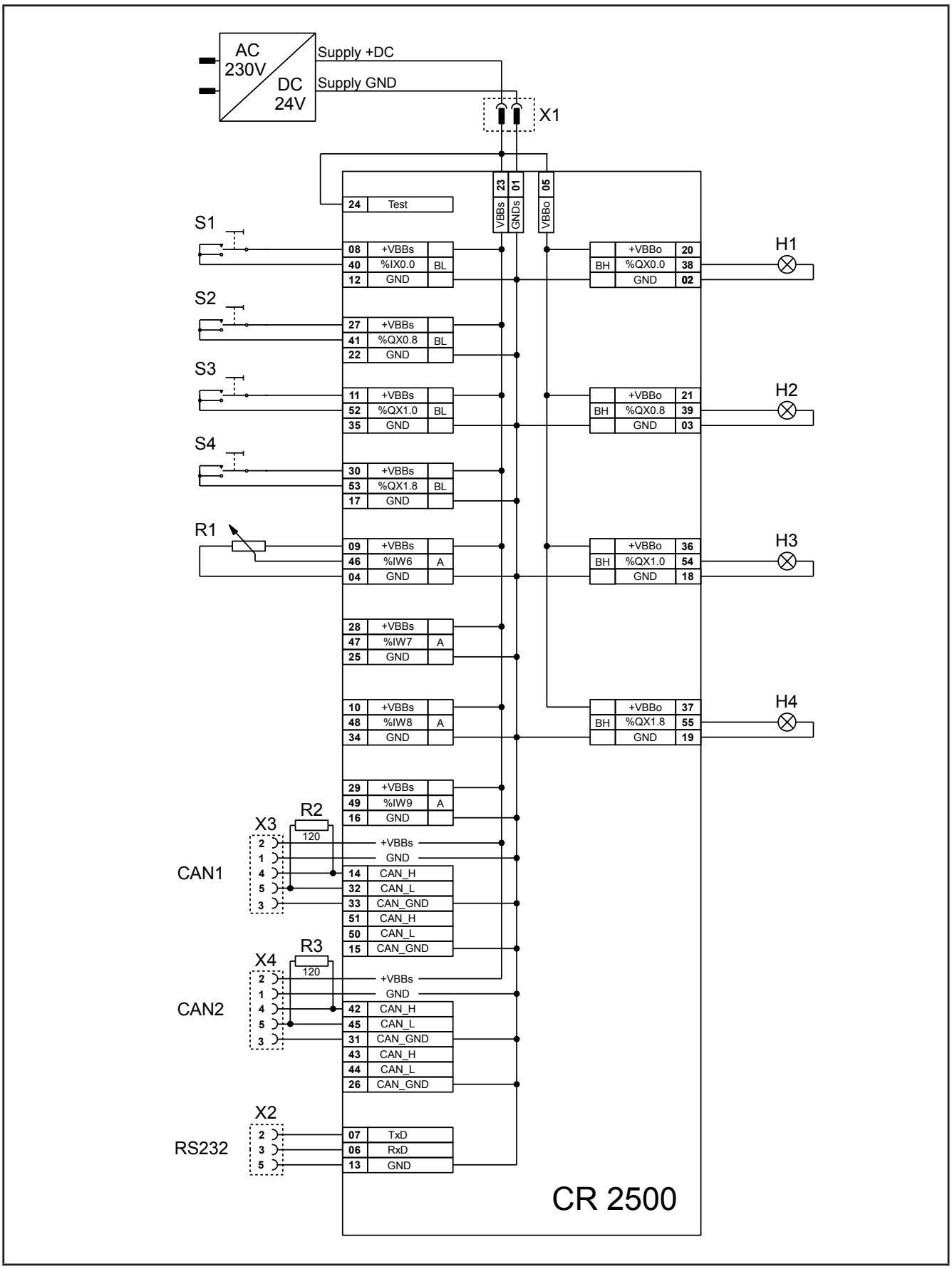
Operating status	Status LED		Description
	Flashing frequency	Colour	
Reset	ON (briefly)	orange	With each power-on reset the following procedure is carried out. The operating system is initialised. Various checks are carried out. This temporary state is followed by the Run state.
Run	2 Hz	green	This state is achieved: ● from the reset state (autostart) ● from the stop state by means of the Run command Prerequisite: Test mode
		red	Run with error

Operating status	Status LED		Description
	Flashing frequency	Colour	
Stop	ON	green	This state is achieved: ● from the reset state if no project is loaded ● from the Run state by giving the stop command via the interface Prerequisite: Test mode
		red	Stop with error
Fatal Error	ON	red	A non tolerable error was found. This state can only be left by a reset.
No operating system *	5 Hz	green	On delivery * The controller is in the boot loader. Before loading the application software the operating system must be downloaded *.

*) does not apply to the controller of the starter set

8 Technical data

8.1 Wiring



Wiring starter set

8.2 Additional information

For application and product examples from the different areas of mobile control technology please refer to our websites.

www.ifm.com → Products → Control systems

Further documents such as the CE declaration of conformity or the e1 test certificate by the Kraftfahrt-Bundesamt (German Federal Office for Motor Traffic) can be downloaded in PDF format.

www.ifm.com → Data sheet direct → CR2500 → More details