FEC Compact

Hardware description

Micro controller IPC FEC Compact with fast counter inputs and flash disk

Description

527 483
en 0109 NH
[677 930]
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Intended use

The Micro PLC (IPC FEC Compact) documented in this manual is intended for the following use:

– Process control of installation
– Further processing of digital data

The IPC FEC Compact is to be used solely as follows:

– for its intended purpose
– in technically excellent condition
– without unauthorised modifications.

When connecting standard components such as sensors and actuators, the specified limit values for pressures, temperatures, electrical data, torques etc., are to be observed.

You will need to comply with the standards and trade association regulations specified in the relevant chapters, as well as of the technical control boards, VDE recommendations or relevant national regulations.

Target group

This documentation is intended solely for trained specialists in control and automation technology with experience in the installation, commissioning, programming and diagnosis of programmable logic controllers (PLC systems).

Service

In the event of technical problems, please contact your local Festo Service.
Important user notes

Danger classification
These notes contain information regarding potential danger which may arise as a result of the incorrect use of this product. They are identified by way of a signal word (warning, caution, etc.), printed against a shaded background and in addition identified by a pictogram. Differentiation is made between the following danger warnings:

**Warning**
... means that, if ignored, serious personal or material damage may be caused.

**Caution**
... means that, if ignored, personal or material damage may be caused.

**Note**
... means that, if ignored, material damage may be caused.
Contents and general instructions

Identification of special information

The following pictograms identify text which contains special information.

**Pictograms**

Information:
Recommendations, tips and references to information sources.

Accessories:
Information about necessary or useful accessories for a Festo product.

**Text marks**

1. Numbers identify activities which are to be carried out in the order specified.
   - Dashes indicate general listings.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro PLC</td>
<td>Programmable logic controller (the product described in this manual: IPC FEC Compact)</td>
</tr>
<tr>
<td>In</td>
<td>Input</td>
</tr>
<tr>
<td>Out</td>
<td>Output</td>
</tr>
<tr>
<td>In/Out</td>
<td>In and/or output</td>
</tr>
<tr>
<td>LED</td>
<td>Light emitting diode</td>
</tr>
<tr>
<td>TTL</td>
<td>Transistor-transistor logic</td>
</tr>
<tr>
<td>TP</td>
<td>Twisted pair</td>
</tr>
</tbody>
</table>

Fig. 0/1: List of abbreviations
Contents and general instructions
Module overview

Chapter 1
1. Module overview

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1. Module overview

1.1 Overview of module variants

Below is an overview of all IPC FEC Compact devices listed in this manual.

<table>
<thead>
<tr>
<th>Module</th>
<th>Description of modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPC FEC FC20</td>
<td>- 12 inputs, 8 relay outputs, 24 V DC&lt;br&gt;- Processor 80186&lt;br&gt;- Main memory 256 kByte&lt;br&gt;- Program memory 256 kByte flash memory&lt;br&gt;- Interface RS232C with KSD2/SM15&lt;br&gt;- Power consumption typ 2.6 W, at 24 V max. 200 mA *)&lt;br&gt;- Operating system Festo FST&lt;br&gt;- Dimensions W x H x D 130 x 80 x 35</td>
</tr>
<tr>
<td>IPC FEC FC21</td>
<td>- 12 inputs, 8 relay outputs, 110 V AC to 230 V AC&lt;br&gt;- Processor 80186&lt;br&gt;- Main memory 256 kByte&lt;br&gt;- Program memory 256 kByte flash memory&lt;br&gt;- Interface RS232C with KSD2/SM15&lt;br&gt;- Power consumption typ 6.7 W, at 230 V AC max. 40 mA *)&lt;br&gt;- Operating system Festo FST&lt;br&gt;- Dimensions W x H x D 130 x 80 x 35</td>
</tr>
<tr>
<td>IPC FEC FC22</td>
<td>- 12 inputs, 8 solid state relay outputs, 24 V DC&lt;br&gt;- Processor 80186&lt;br&gt;- Main memory 256 kByte&lt;br&gt;- Program memory 256 kByte flash memory&lt;br&gt;- Interface RS232C with KSD2/SM15&lt;br&gt;- Power consumption typ 2.6 W, at 24 V max. 200 mA *)&lt;br&gt;- Operating system Festo FST&lt;br&gt;- Dimensions W x H x D 130 x 80 x 35</td>
</tr>
</tbody>
</table>

*) max. inclusive of 100 mA sensor supply
## 1. Module overview

<table>
<thead>
<tr>
<th>Module</th>
<th>Description of modules</th>
</tr>
</thead>
</table>
| IPC FEC FC23 | 12 inputs, 8 solid state relay outputs, 110 V AC to 230 V AC  
- Processor 80186  
- Main memory 256 kByte  
- Program memory 256 kByte flash memory  
- Interface RS232C with KSD2/SM15  
- Power consumption typ 6.7 W, at 230 V AC max. 40 mA *)  
- Operating system Festo FST  
- Dimensions W x H x D 130 x 80 x 60 |
| IPC FEC FC30 | 12 inputs, 8 outputs (2 relays, 6 transistors), 24 V DC  
- Processor 80186  
- Main memory 512 kByte  
- Program memory 512 kByte 8 bit flash  
- Interface RS232C via SM14/15  
- Power consumption typ 2.5 W, at 24 V max. 180 mA *)  
- Operating system Festo FST, Multiprog  
- Dimensions B x H x T 130 x 80 x 35 |
| IPC FEC FC34 | 12 inputs, 6 outputs (2 relays, 8 transistors), 24 V DC  
- Processor 80186  
- Main memory 512 kByte  
- Program memory 512 kByte flash  
- Interface RS232C via SM14/-15  
- Power consumption typ 2.5 W, at 24 V max. 180 mA *)  
- Operating system Festo FST, Multiprog  
- Dimensions W x H x D 130 x 80 x 35 |

*) max. inclusive of 100 mA sensor supply

Fig. 1/1: Overview of module variants
1. Module overview

1.2 Description of components

1.2.1 Module input side - IPC FEC FC20, FC21, FC22, FC23 and FC30

The module is equipped with the following connection and display elements:

1. Sensor supply 24 V DC
2. Sensor supply 0 V
3. Input In 0.0 to In 0.7
4. Common potential S0 for In 0.0 to In 0.7
5. Input In 1.0 to In 1.3
6. Common potential S1 for In 1.0 ... In 1.3
7. RUN/STOP switch
8. Analogue potentiometer (trimmer)
9. Power LED (voltage supply, operating voltage)
10. Status LED (Run/Stop/Error)

Fig. 1/2: Connection and display elements of module IPC FEC Compact
1. Module overview

1.2.2 Module output side - IPC FEC FC20 and FC22

The module is equipped with the following connection and display elements:

1. Operating voltage 24 V DC
2. Operating voltage 0 V
3. Operational earthing
4. Relay outputs Out 0.0 to Out 0.3*
5. Common connection C0 for Out 0.0 to Out 0.3
6. Relay outputs Out 0.4 and Out 0.5*
7. Common connection C1 for Out 0.4 and Out 0.5
8. Relay outputs Out 0.6 and Out 0.7*
9. Common connection C2 for Out 0.6 and Out 0.7
10. Connection for extension (EXT)
11. Serial interface (COM)

Fig. 1/3: Connection and display elements of module IPC FEC FC20, FC22

*) Solid state relays are used in the case of the IPC FEC FC22
1. Module overview

1.2.3 Module output side IPC FEC FC21 and FC23

The module is equipped with the following connection and display-elements:

Fig. 1/4: Connection and display elements of module IPC FEC FC21, FC23

*) Solid state relays are used in the case of the IPC FEC FC23
1. Module overview

1.2.4 Module output side - IPC FEC FC30

The module is equipped with the following connection and display elements:

1. Operating voltage 24 V DC
2. Operating voltage 0 V
3. Operational earthing
4. Common connection C0 for Out 0.0 and Out 0.1
5. Relay outputs Out 0.0 and Out 0.1
6. Transistor outputs Out 0.2 to Out 0.7
7. Output supply C+ (nominal 24 V DC); for Out 0.2 to Out 0.7 and for the actuation of relay coils
8. Output supply C- (0 V)
9. Connection for extension (EXT)
10. Serial interface (COM)

Fig. 1/5: Connection and display elements of module IPC FEC FC30
1. Module overview

1.2.5 Module input side IPC FEC FC34

The module is equipped with the following connection and display elements:

1. Sensor supply 24 V DC
2. Sensor supply 0 V
3. Input In 0.0 to In 0.7
4. Common potential S0 for In 0.0 to In 0.7
5. Input In 1.0 to In 1.3
6. Common potential S1 for In 1.0 ... In 1.3
7. RUN/STOP switch
8. Analogue potentiometer (trimmer)
9. Power LED (voltage supply, operating voltage)
10. Status LED (Run/Stop/Error)

Fig. 1/6: Connection elements of module IPC FEC FC34
1. Module overview

1.2.6 Module output side IPC FEC FC34

1. Operating voltage 24 V DC
2. Operating voltage 0 V
3. Operational earthing
4. Common connection C0 for Out 0.0 to Out 0.1
5. Relay outputs Out 0.0 to Out 0.1
6. Transistor outputs Out 0.2 to Out 0.7
7. Output supply C+ (nominal 24 V DC); for Out 0.2 to Out 0.7 and for the actuation of relay coils
8. Output supply C-
9. Connection for extension (EXT)
10. Serial interface (COM)
11. Network interface 10Base T
12. Link/Traffic LED for network activity

Fig. 1/7: Connection elements of module IPC FEC FC34
Assembly

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2.1 Mounting of the IPC FEC Compact

The IPC FEC Compact can be mounted both on the top-hat rail or directly on a wall by means of two mounting screws.

Do not mount the IPC FEC Compact
- in areas subject to excessive dust, oil mist, conductive dust or corrosive gas
- directly in areas subject to shock or vibration
- in areas subject to high temperatures, direct solar irradiation, humidity or rain
- in the proximity of high-voltage equipment or cables

Caution
Make sure that no wire fragments, fillings or swarf drop into the device when drilling holes or connecting wires.

Do not mount the IPC FEC Compact directly above a heat-generating source such as a heater, a current converter or high wattage resistor.

Caution
Should the ambient temperature in the control cabinet be in excess of 55 °C, a ventilator will need to be installed for external ventilation.
2. Assembly

2.2 Top-hat rail mounting

The IPC FEC Compact is suitable for mounting on a top-hat rail (mounting rail to EN 50022). No additional accessories are required for this. The IPC FEC Compact can be latched into the top-hat rail with the help of the built-in mounting clip.

2.2.1 Procedure for top-hat rail mounting

1. Hook the IPC FEC Compact into the upper part of the rail.
2. Press the bottom section of the module with your hand against the top-hat rail.
3. The module now automatically engages in the top-hat rail.

![Fig. 2/1: IPC FEC Compact Mounting diagram](image-url)
2. Assembly

2.2.2 Procedure for top-hat rail dismantling

Caution
The IPC FEC Compact must never be removed from a top-hat rail in the wired-up state. In order to remove the IPC FEC Compact all cable connections must be disconnected.

1. Slightly pull the white mounting clip underneath the module downwards using a suitable tool.

2. This disengages the FEC Compact. Hold on to the module with one hand to make sure that it is not dropped.
2. Assembly

2.3 Wall mounting

The IPC FEC Compact is suitable for wall mounting. Fixed integrated mounting holes (4 mm) are located on both sides of the IPC FEC Compact for this.

Observe the distances between the holes. The required screw diameter is 4.0 mm. The diameter of the screw head should not be greater than 8.5 mm.

Fig. 2/2: IPC FEC-Drilling distances
2. Assembly

2.3.1 Procedure for wall mounting

1. Place the holes taking into consideration the existing surface. See (fig. 2/2) for the appropriate hole distances to mount your IPC FEC Compact.

2. Mount the IPC FEC Compact at the requisite point by means of two screws of the type described.

2.3.2 Procedure for dismantling of wall mounting

**Warning**

Never dismantle an IPC FEC Compact from a wall in its wired state. All cable connections must be disconnected prior to dismantling the IPC FEC Compact.

1. Loosen the two mounting screws fixing the IPC FEC Compact to the wall with the help of a suitable screwdriver.

2. When loosening the screws, hold on to the IPC FEC Compact with one hand to make sure that it is not dropped.
2. Assembly

2.4 Additional notes regarding top-hat rail mounting

The IPC FEC Compact can be relocated on the top-hat rail. The white clip presses the IPC FEC Compact moderately firmly against the top-hat rail so that it can be moved along the top-hat rail subsequently if desired.
2. Assembly

2.5 Module earthing

**Caution**

It is not permissible to connect several devices via the same earth conductor (several IPC FEC’s in series).

Establish a conductive connection between operational earthing and earth potential.

![Non permissible earthing](image1)

**Fig. 2/3: Non permissible earthing**

![Permissible earthing](image2)

**Fig. 2/4: Permissible earthing**
2. Assembly

2.6 Important instructions for installation

Only power packs which ensure a safe separation of the operating voltage to IEC 742 / EN 60742 / VDE 0551, PELV, with a minimum insulation resistance of 4 kV, must be used for the 24 V DC operating voltage supply (power connections) and for the voltage supply of the digital inputs (nominal 24 V DC).

Switch power packs with safe insulation in accordance with EN 60950 / VDE 0805 are permissible.

Power pack PS1 PSE3 meets the requirements described.

The maximum length of the power supply cable must not exceed 10 m.

The maximum length of the connected cable for input and output signal connections is 30 m.

The operational earthing connection of each individual FEC is to be separately connected to the earth potential.

The 24 V DC sensor supply provided for modules FEC FC21 and FC23 meets the above requirement subject to the safe separation of the mains voltage and can therefore be used for the supply of digital inputs provided that, for instance for reasons of noise immunity, the electrical isolation from the internal system voltage is not required.

The power relays used permit the direct switching of overvoltage category II mains voltages; the insulation resistance between contacts and coil is higher than 4 kV.

The solid state modules used in module types FEC FC22 and 23 also permit the switching of overvoltage category II AC voltages.
2. Assembly

In the case of module variant FEC FC34 for TP and cross-over cables, use only a screened cable. TP cables of S/STP (mind. CAT5) are to be provided. The screens are to be connected on both sides over a large area and with low impedance to interference-free earth. The housing of the hub used must also be earthed with low impedance.
2. Assembly
Installation

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3. Installation

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3. Installation

3.1 What you need for the hardware installation

- An IPC FEC Compact (scope of delivery)
- A voltage supply
  24 V DC (e.g. PS1 PSE3) for FC20, FC22, FC30 FC34 or 110 to 230 V AC for FC21 and FC23
- An interconnecting cable
  PS1 SM14, for FC30 and FC34 or FEC KSD2 for FC20, FC21, FC22, FC23 to be able to establish a connection between the IPC FEC Compact and an external computer.
- An external computer such as a PC or Laptop with a free communication interface and installed Windows operating system.

3.2 Notes on installation

Consider the ambient conditions in which the device is to operate normally when installing the IPC FEC Compact.

Caution
Prior to working on the IPC FEC Compact, you will need to discharge your body. To do so, touch some earthed objects (e.g. earthed top-hat rail, blank cabinet sections or similar).

Note
Should the ambient temperature in the control cabinet be over 55 °C, a ventilator will need to be installed for external ventilation.
3. Installation

3.2.1 COM interface for IPC FEC FC20, FC21, FC22, FC23

<table>
<thead>
<tr>
<th>RJ plug, 4-pin</th>
<th>Pin No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>RXD</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>TXD</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>DTR</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>

Fig. 3/1: COM interface RS232 level, 4-pin

This communication interface operates using signal levels within a range of ±5 V to ±15 V.

Use only use the accessories provided for this (KSD2).

Caution
Make sure that the external voltage supply is switched off until the controller is installed.
3. Installation

3.2.2 COM interface for IPC FEC FC30, FC34

---

**Caution**
This COM interface is operated at TTL levels (5 V) Use only the accessories provided for this, e.g. PS1 SM14

---

<table>
<thead>
<tr>
<th>RJ12 plug</th>
<th>Pin No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>+5V</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>TXD</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>RXD</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CTS</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>RTS</td>
</tr>
</tbody>
</table>

Fig. 3/2: COM interface (6-pin)
3. Installation

3.2.3 Extension interface (Ext)

**Caution**
The extension interface of the IPC FEC Compact operates at TTL level (5 V). Use only the accessories provided for this (PS1 SM14/SM15).

<table>
<thead>
<tr>
<th>RJ12 plug</th>
<th>Pin No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>+5V</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>TXD</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>RXD</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CTS</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>RTS</td>
</tr>
</tbody>
</table>

Fig. 3/3: Extension interface, 6-pin
3. Installation

3.2.4 Pin allocation of the network interface (TP)

The network functions of the FEC FC34 module can be utilised via the 8-pin RJ45 socket (10Base T).

The network interface acts both as the networking of several IPC FECs and the interface of the IPC FEC Compact to a higher-order controller or visualisation unit.

<table>
<thead>
<tr>
<th>RJ45 plug (10Base T)</th>
<th>Pin No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TD-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>RD+</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>not allocated</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>not allocated</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RD-</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>not allocated</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>not allocated</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3/4: Network interface (TP) for IPC FEC FC34

The Ethernet interface on your controller enables you:
- to communicate between the controllers (sending and receiving of data)
- to program and operate the controllers via Ethernet
- to transmit controller data to an office network (DDE server, OPC server) and to utilise the controller as a WEB server in order to visualise and/or operate (FST only) the machine process via a browser
3.3 The communication interfaces COM, EXT and TP

The communication interface COM can be used both as an electrical isolated RS232 programming interface in conjunction with the programming cable KSD2 (for FC20, FC21, FC22 and FC23), and interface at TTL level in conjunction with the programming cable PS1 SM14 (for FC30 and FC34).

EXT is a virtual TTL interface. A PS1 SM15 is required for use as an RS232.

The Ethernet interface (designation TP) is a standardised twisted pair interface for Ethernet 10Base T (10 Mbits/s) with RJ45 connection.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Cable</th>
<th>Device module</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM</td>
<td>KSD2</td>
<td>FC20, -21, -22, -23</td>
<td>Use as programming interface</td>
</tr>
<tr>
<td>COM</td>
<td>PS1 SM14</td>
<td>FC30, FC34</td>
<td>Use as programming interface</td>
</tr>
<tr>
<td>EXT</td>
<td>PS1 SM15</td>
<td>All IPC FEC Compact</td>
<td>Use with RS232 devices</td>
</tr>
<tr>
<td>TP</td>
<td>is to be provided by the user</td>
<td>FC34</td>
<td>Use for Ethernet 10Base T</td>
</tr>
</tbody>
</table>

Note
Not all signals in accordance with EIA RS232C are available for COM and EXT. The signals transmit, receive and RTS/CTS are available for SM14/SM15. If other signals are required, these will need to be simulated by means of bridges.

The cable length (SM14/SM15 interface converter plus null modem cable) must not exceed 3 m.
3. Installation

1 PS1 SM14: Programming cable + interface converter TTL-RS232
2 PS1 SM15: Interface converter TTL-RS232
3 KSD2 Programming cable (150 cm long)

Fig. 3/5: Use of the interface cables
3. Installation

3.3.1 Intended use of SM14/SM15

The SM14 programming cable should not be used in the sense of industrial installation. The scope of delivery of the SM14 includes a null modem cable.

The pin allocation of the SM15 corresponds to that of the SM14. The specifications of the EIA (Electronic Industrial Association) for RS232-C are to be observed when realising a serial communication interface.

The interface converter TTL-RS232 PS1 SM15 was designed for the industrial installation of serial communication. The scope of delivery of the PS1 SM15 does not include a null modem cable. A suitable cable is to be configured in accordance with the table below. A screened cable (braided screen, 80% cover) is necessary in order to obtain adequate noise immunity. The screen is to be installed with low impedance over a large area.

<table>
<thead>
<tr>
<th>Typical configuration of null modem cable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plug A</strong></td>
</tr>
<tr>
<td>Pin 1 and 6</td>
</tr>
<tr>
<td>Pin 2</td>
</tr>
<tr>
<td>Pin 3</td>
</tr>
<tr>
<td>Pin 4</td>
</tr>
<tr>
<td>Pin 5</td>
</tr>
<tr>
<td>Pin 7</td>
</tr>
<tr>
<td>Pin 8</td>
</tr>
<tr>
<td>Pin 9</td>
</tr>
</tbody>
</table>
3. Installation

3.3.2 Connection example for the programming of the IPC FEC Compact

Below are various examples of how the IPC FEC Compact can be correctly and usefully installed.

A direct connection can be established between the IPC FEC FC3X and an external computer with the help of the connection cable PS1 SM14. This offers you the option of installing your own user programs with the IPC FEC Compact. Further information about this is available on the relevant description of the FST or Multiprog-CD.

![Diagram showing connection example](image)

1 IPC FEC Compact
2 External computer
3 Connecting cable SM14 (cable length max. 3 m)

Fig. 3/6: Programming example IPC FEC FC 30 with external computer (only for all IPC FEC FC3x variants)
3.3.3 Connection example of direct network (Ethernet only)

Direct networking of two IPC FEC FC 34 can be set up via the network interface (TP). The illustration below shows the requires allocation of the cross-over cable. The cable length must not exceed 100 m. A TP cable Type S/STP (min. CAT5) is to be provided.

Fig. 3/7: Networking via TP interface
3. Installation

3.3.4 Connection example of network (10Base T)

MA network with more than 2 IPC FEC FC34 can be configured with the help of the network interface (TP). The number of IPC FECs that can be networked together is dependent on the type and number of hubs used (star connector). The cable length of each individual IPC FEC FC34 connected to a hub must not exceed 100 metres. TP cables Type S/STP (min. CAT5) are to be provided. It is not necessary to observe a minimum distance between them.

Fig. 3/8: Network (10Base T)

1 IPFC FEC Compact
2 Hub
3 Programming station (e.g. Laptop with network card)
4 Twisted-pair cable
3. Installation

3.3.5 Connection example of voltage supply wiring

1 Power pack PS1 PSE3
2 Supply voltage line (line length max. 10 m)
3 IPC FEC Compact

Fig. 3/9: Voltage supply wiring of IPC FEC Compact (for all 24 V DC variants, not for FC21 and FC23)
3. Installation

3.4 Service life of relay output contacts

<table>
<thead>
<tr>
<th>Current / load</th>
<th>Ohmic load</th>
<th>Inductive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>No current</td>
<td>20,000,000 cycles</td>
<td>20,000,000 cycles</td>
</tr>
<tr>
<td>0.2 A</td>
<td>1,000,000 cycles</td>
<td>800,000 cycles</td>
</tr>
<tr>
<td>1 A</td>
<td>500,000 cycles</td>
<td>300,000 cycles</td>
</tr>
<tr>
<td>2 A at 250 VAC/30VDC</td>
<td>300,000 cycles</td>
<td>100,000 cycles</td>
</tr>
<tr>
<td>5 A max. at 250 VAC/30VDC</td>
<td>100,000 cycles</td>
<td>–</td>
</tr>
</tbody>
</table>

Note
When using inductive loads, it may be necessary to take measures for transient voltage suppression.

FEC FC20 and FC21 only have relay outputs, FEC FC22 and FC23 have solid state relays, all FEC FC3X have relay and transistor outputs.
3. Installation

3.5 Output performance with overload/short circuit of the FC30/FC34

The transistor outputs Out 0.2 to Out 0.7 are independently short circuit and overload protected.

If a short circuit or overload current is applied, this causes the switching transistor to heat up. The overtemperature protection switches off the output affected to enable the switching transistor to cool down again.

Subsequently, the output concerned is re-activated. Should an overload current still be applied after this, then the process will be repeated.

The cycle duration of this process depends on the magnitude of the overload. In the case of minimal overload the duration of the cycle may take up to several minutes and with high overload less than 1 second.
3. Installation

3.6 Notes regarding the wiring of the IPC FEC Compact

**Caution**
Do not switch on the voltage supply after the Power 24 V DC connection has been wired up until the entire installation has been completed.

**Note**
Separate the signal input and output lines into separate cable ducts and avoid bundling the lines together. Do not use the same multi-core cable for wiring the signal inputs and outputs.

**Caution**
Check the supply voltage and earth connections as well as the input/output connections prior to switching on the power.

Make sure that the mounting screws and screw terminals for the external connection are tightly secured. The external connections must not exhibit any visible damage.

**Warning**
Make sure that the supply voltages of the IPC FEC Compact are separate prior to replacing cables or similar.

Should it be necessary to measure the maximum insulation voltage and insulation resistance of the IPC FEC Compact, you will need to separate the input and output lines and the supply voltages of the IPC FEC Compact. Carry out the measuring test across a common point of all connections and the earth terminal.

For loads such as forward/reverse motor contactors which can be dangerous if switched on simultaneously, interlocks both external to the module and programmed interlocks.
should be provided. This will prevent loads of this type from being activated simultaneously.

**Note**
For EMERGENCY-STOP functions the output loads should be switched off via a switch external to the module which separates the load voltage from the output terminals.
When connecting an EMERGENCY-STOP circuit make sure that the national wiring and safety regulations are observed.

The connection of a transient voltage suppressor in parallel with an inductive load reduces the generation of electrical interference.

**Caution**
The operating voltage of the IPC FEC Compact is protected against reverse polarity. However, you should still check the polarity prior to commissioning.
The supply voltage of the transistor outputs on the IPC FC30/34 must not be polarised. External protection is recommended.
Initial steps / Commissioning

Chapter 4
4. Initial steps / Commissioning

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</tr>
</tbody>
</table>
4. Initial steps / Commissioning

4.1 Initial steps - IPC FEC Compact

The following provides a brief introduction for the use of the IPC FEC Compact.

You will need:

- an IPC FEC Compact and depending on type
- a 24 V DC voltage supply (e.g. PS1 PSE3) for FC20, FC22, FC30, FC34
- the connecting cable PS1 SM14 if using the modules IPC FEC FC30 and FC34 for connection with the FEC and an external programming PC
- the cable FEC KSD2 if using the module IPC FEC FC20, FC21, FC22, FC23 for connection with the afore mentioned module and an external programming PC
- a programmingPC with free ferial interface COM1 or COM2 or COM3 or COM4 (preferably a 9-pin SUB-D connection) and operating system Windows 9X, NT, ME or 2000
- the programming software "FST4.02" or "MULTIPROG 2.01 (06/2001) for FEC" or later
4. Initial steps / Commissioning

4.1.1 Connecting the IPC FEC Compact to voltage

Use the connections designated with “power” to connect the voltage supply to the IPC FEC Compact (observe type of voltage AC / DC). The connections designated with “sensor supply” may be used for the supply of sensors up to 100 mA / 24 V DC total current.

**Caution**

Make absolutely sure that the cables are wired with correct polarity.

Now switch on the voltage supply for the purposes of testing. The power LED must be illuminated.
4. Initial steps / Commissioning

![Block circuit diagram of voltage supply](image)

1. PSE3 Voltage supply
2. Voltage supply line (max. line length 10 m)
3. IPC FEC Compact

Bild 4/1: Block circuit diagram of voltage supply (for all 24 V DC variants, not for FC21 and FC 23)

**Caution**
Prior to continuing with any further wiring, you will need to disconnect the power supply from the IPC FEC Compact again.
The wiring of solid wires is effected in the same way as that of the assembly of wires with cable end sleeve. These can simply be inserted into the appropriate terminal.

**Warning**
The stripped wires of the cable must not project beyond the terminal area.

**Caution**
The max. permissible acceptable current load must be observed.
4. Initial steps / Commissioning

4.1.2 Connection example 1

Input In 0.1 current sinking (PNP)
Output Out 0.1;
Switching voltage of relay outputs
Out 0.0 to Out 0.3: 24 V DC

Bild 4/3: Connection example using IPC FEC FC20

1 Sensor
2 Common connection C0 for Out 0.0 to Out 0.3
3 Actuator
4 Operational earthing
5 Power pack 24 V DC e.g. PSE3
6 IPC FEC FC20
4. Initial steps / Commissioning

4.1.3 Connection example 2

Input In 0.1 current sinking (PNP)
Output Out 0.1; switching voltage of relay outputs Out 0.0 to 0.3: 230 V AC

1 Sensor
2 Common connection C0 for Out 0.0 to Out 0.3
3 Actuator
4 Operational earthing
5 AC voltage, e.g. 230 V AC
6 IPC FEC FC21

Bild 4/4: Connection example of IPC FEC FC21 using AC voltage
4. Initial steps / Commissioning

4.1.4 Connection example 3

Input In 0.1 current sourcing (NPN)
Output Out 0.1; switching voltage of solid state relay outputs
Out 0.0 to Out 0.3: 24 V DC

1. Sensor
2. Common connection C0 for Out 0.0 to Out 0.3
3. Actuator
4. Operational earthing
5. Mains voltage, 24 V DC, e.g. PSE3
6. IPC FEC FC22

Bild 4/5: Connection example using IPC FEC FC22
4. Initial steps / Commissioning

4.1.5 Connection example 4

Input In 0.1 current sinking (PNP)
Output Out 0.1; switching voltage of solid state relay outputs
Out 0.0 to 0.3: 230 V AC

Bild 4/6: Connection example of FEC FC23 with AC voltage connected

1 Sensor
2 Common connection C0 for Out 0.0 to Out 0.3
3 Actuator
4 Earth connection
5 Mains voltage, 24 V DC, e.g. PSE3
6 IPC FEC FC23
4. Initial steps / Commissioning

4.1.6 Connection example 5

Input In 0.1; current sinking (PNP)
Output Out 0.1: Switching voltage of relay outputs Out 0.0 and 0.1, transistor outputs Out 0.2 to Out 0.7; 24 V DC

Sensor

C+ C- supply voltage
Transistor outputs

Actuator connected to transistor output

Operational earthing

Mains voltage, 24 V DC, e.g. PSE3

IPC FEC FC30

Bild 4/7: Connection example using IPC FEC FC30
4.1.7 Connection example 6

Input In 0.1; current sinking (PNP)
Output Out 0.1; switching voltage of relay outputs Out 0.0
and 0.1, transistor outputs Out 0.2 to Out 0.7: 24 V DC

Bild 4/8: Connection example using IPC FEC FC34
4. Initial steps / Commissioning

4.1.8 Installing the programming software on your PC

For the programming of the IPC FEC Compact you will require either the FST4 software in version 4.02 or later or the MULTIPROG 2.01 software, release date 04/2001 or later.

Please note that an IPC FEC Compact can only be programmed either with FST or with MULTIPROG.

The rating plate of the controller indicates the variant to be used.

1 Rating plate for FST variant
2 Rating plate for Multiprog variant

Bild 4/4: Labelling difference between the FEC language variants

If FST is to be used for programming, you should install the FST4.02 software.

If MULTIPROG is to be used, you should install MULTIPROG for FEC version 2.01.
4. Initial steps / Commissioning

4.1.9 The first project using the IPC FEC Compact in FST

Proceed as follows:

1. Connect the IPC FEC Compact to the voltage as described above. In addition, at least one sensor needs to be connected.

2. Install the FST software 4.02 (or later) on your programming PC, unless already installed.

4. Start the FST software.

5. Open a new project via the menu “Project/New“.

Bild 4/5: FST programming, screen 1
4. Initial steps / Commissioning

6. Allocate a project name.
4. Initial steps / Commissioning

7. Select the IPC FEC Compact as controller

Bild 4/7: FST programming, screen 3

8. Enter a comment, if desired.

The I/O configuration for digital inputs and outputs is automatically created.
9. Note that COM1 has been preset as the interface on the programming PC. If you wish to use COM2, then go to the menu Extras and open “FST settings” and there the tap “communication” and select the desired interface.
4. Initial steps / Commissioning

10. Insert a new program with the number 0 in the project
(right mouse click Programs, New Programs)

Bild 4/9: FST Programming, screen 5
4. Initial steps / Commissioning

11. Program as follows:

```
IF
THEN
LOAD IWO
TO OWO
```

Bild 4/10: FST programming, screen 6
12. If an input in the allocation list is requested, you can assign a symbolic name and a comment.

Bild 4/11: FST programming, screen 7

13. Click onto “Load Project”.

Bild 4/12: FST programming, screen 8
14. Now switch the RUN/STOP switch from Stop to Run. The Run LED on the IPC FEC Compact will now change to Green.

15. Then generate an input signal to one input of group In 0, this should cause the output at the corresponding position of the output module Out 0 to switch to 1.

16. Check your program by switching to online mode: Click onto your program with the righthand mouse button, online

Bild 4/13: FST programming, screen 9

17. Check your program by switching on the online display.

Bild 4/14: FST programming, screen 10
4. Initial steps / Commissioning

4.1.10 Overview of retentive operands

<table>
<thead>
<tr>
<th>Operand</th>
<th>Operand number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register (Rx)</td>
<td>0 to 127</td>
</tr>
<tr>
<td>Timer preselect (TPx)</td>
<td>0 to 127</td>
</tr>
<tr>
<td>Counter (Ccx)</td>
<td>0 to 127</td>
</tr>
<tr>
<td>Counter preselect (CPx)</td>
<td>0 to 127</td>
</tr>
<tr>
<td>Counter word (CWx)</td>
<td>0 to 127</td>
</tr>
<tr>
<td>Flag word (FWx)</td>
<td>0 to 255</td>
</tr>
</tbody>
</table>

4.1.11 Overview of operands

<table>
<thead>
<tr>
<th>Operand</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input word</td>
<td>IW 0 to IW 255 with IX .0 to IX .15</td>
</tr>
<tr>
<td>Output word</td>
<td>OW 0 to OW 255 with OX .0 to OX .15</td>
</tr>
<tr>
<td>Error word</td>
<td>EW, also as E</td>
</tr>
<tr>
<td>Flag word</td>
<td>FW0 to FW9999 with Mx. 0 to Mx.15</td>
</tr>
<tr>
<td>Register</td>
<td>R0 to R255</td>
</tr>
<tr>
<td>Function units</td>
<td>FU0 to FU255, FU32 to FU38 per program</td>
</tr>
<tr>
<td>Timer</td>
<td>T0 to T255 (also TP and TW for each timer TI, TO)</td>
</tr>
<tr>
<td>Counter</td>
<td>C0 to C255 (also as CV and CW for each counter)</td>
</tr>
<tr>
<td>Programs</td>
<td>P0 to P63</td>
</tr>
<tr>
<td>Program status</td>
<td>PS0 to PS63</td>
</tr>
<tr>
<td>Function modules</td>
<td>CFMO to CFM99 predefined by Festo or freely selectable</td>
</tr>
<tr>
<td>Program modules</td>
<td>CMP0 to CMP99 (user definable)</td>
</tr>
</tbody>
</table>
4. Initial steps / Commissioning

4.1.12 The first project using the IPC FEC FC30 or FC34 in MULTIPROG

Proceed as follows:

1. Connect your IPC FEC Compact to the voltage supply as previously described. Connect at least one sensor at input 0 of group In 0.0. The voltage supply is to be connected at the output plug (to enable you to check with the help of the LEDs whether an output switches).

2. Install MULTIPROG 2.01 Release 2001/04 (or later) on you programming PC, unless already installed.

3. Connect the controller and PC with the programming cable PS1 SM14. Use the COM connection on the IPC FEC FC30/34 and COM1 or COM2 etc. on the programming PC.

4. Start MULTIPROG.

5. Open a new project via the menu “Project/New”.

Bild 4/15: MWT programming, screen 1
4. Initial steps / Commissioning

6. Select an appropriate template for your controller

Bild 4/16: MWT programming, screen 2

7. Store the new program under an appropriate name

Bild 4/17: MWT programming, screen 3
8. The template now contains a complete program which transmits the signal at input In 0.0 to output Out 0.0. Following this, compile the project (menu Code, create New Project).
9. Check the serial interface for the connection to the controller. The default entered in your project is COM1. Your PC may require COM2. You will find the setting by clicking onto the resource with your right mouse button (e.g. FC34 in the subdirectory Config in the Physical Hardware directory). This will open the menu listing the item “settings”.

Bild 4/19: MWT programming, screen 5
4. Initial steps / Commissioning

10. Open the control dialog

Bild 4/21: MWT programming, screen 7
4. Initial steps / Commissioning

11. Send the project to the controller.

Bild 4/22: MWT programming, screen 8

Bild 4/23: MWT programming, screen 9
4. Initial steps / Commissioning

12. Start the controller with a cold start in the control dialog.

13. Now transmit an input signal to input In 0.0 to switch the Out 0.0 to 1.

14. Check your program by switching to the online mode.

15. Make sure that the template contains a sample program of this type in each of the IEC 6 1131-3 programming languages. You can switch on the debug mode for the actual program being executed. For this it needs to be entered in Task 1 of the subdirectory Tasks.
4. Initial steps / Commissioning

Bild 4/26: MWT programming, screen 12
4. Initial steps / Commissioning

4.2 Display elements

4.2.1 Run LED

The IPC FEC Compact has a Run LED, which can be illuminated in the colours green, red and orange. Each colour indicates an operating status of the IPC FEC Compact. The colour for each user program can be set under Multiprog.

4.2.2 Power LED

The FEC has a power Power-LED which lights up green, if the voltage supply is applied.

4.2.3 Run-Stop switch

The slide switch fitted at the top righthand side can be interrogated by the software. If the slide switch is at Stop, the RUN-LED is illuminated orange. If the slide switch is switched to RUN and the system contains a project, then a project if started and the LED is illuminated green. If the Run STOP switch is at RUN and the system does not contain a project, this constitutes an error and the LED lights up red.

4.2.4 Analogue potentiometer (trimmer)

The FEC contains an analogue potentiometer which, with the help of a screwdriver can be set within a decimal value range of 1 to 63. This value can be evaluated by the software used. With this integrated feature it is possible to cost-effectively perform tasks such as the “fine tuning” of operating parameters (e.g. counter values), as well as a wide range of similar tasks.
4. Initial steps / Commissioning

4.3 The fast counters

The two inputs In 1.2 and In 1.3 can be configured as fast counter inputs independently of one another, via which counter pulses of up to a frequency of 2 kHz can be counted. The counters have a density of 16 bit (0 to 65535). Inputs configured as counters can also be simultaneously read as normal digital inputs.

Bild 4/27: Configuration as fast counter inputs
4. Initial steps / Commissioning

4.4 The incremental encoder

The software of the IPC FEC has a density of 16 bit-Incremental encoder (also known as AB-direction detection), which is capable of processing counter pulses of up to 200 Hz. The connection is effected via the two interrupt inputs In 1.0 and In 1.1. An optional reference switch can be connected via input In 0.7.

<table>
<thead>
<tr>
<th>FEC-Type</th>
<th>Inputs</th>
<th>Reference switch input</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC20</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
<tr>
<td>FC21</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
<tr>
<td>FC22</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
<tr>
<td>FC23</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
<tr>
<td>FC30</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
<tr>
<td>FC34</td>
<td>In 1.0 and In 1.1</td>
<td>In 0.7</td>
</tr>
</tbody>
</table>

Bild 4/28: Configuration as incremental encoder
4. Initial steps / Commissioning
Fault finding

Chapter 5
5. Fault finding

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  5.2 Fault / Remedy ....................................................... 5-4
5. Fault finding

5.1 Notes regarding fault finding

**Note**  
Make sure that the notes regarding installation listed in the manual have been correctly followed.

**Note**  
Verify that undamaged cables conforming to standards have been used to connect the IPC FEC.

**Note**  
Make absolutely sure that a correct voltage is available for the IPC FEC Compact.
5. Fault finding

5.2 Fault / Remedy

<table>
<thead>
<tr>
<th>Fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The IPC FEC Compact does not respond</td>
<td>– The IPC FEC Compact needs to be re-started.</td>
</tr>
<tr>
<td></td>
<td>– To do so, briefly disconnect the power supply to the IPC FEC Compact for a few seconds.</td>
</tr>
<tr>
<td>The status of the I/O monitoring LED does not correspond to the actual output status.</td>
<td>– You should check whether the output device functions correctly.</td>
</tr>
<tr>
<td></td>
<td>– Check whether the required voltage is applied to the common terminals for the outputs.</td>
</tr>
<tr>
<td>The operating status of the input device does not correspond to the status of the I/O monitoring LED for this input</td>
<td>– Check the input device for correct operation, loose connections or other abnormalities.</td>
</tr>
<tr>
<td></td>
<td>– An input which is switched on or off again within a time period shorter than the operating cycle or the sensing time of 5 ms of the module may not be detected.</td>
</tr>
</tbody>
</table>
## 5. Fault finding

<table>
<thead>
<tr>
<th>Fault</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| The module does not read any input values or does not input values to the outputs | - Check whether the voltage supply for the inputs and outputs is correctly applied at the individual ports (In 0, In 1, Out 0...),  
- The I/O configuration of the programming software is to be checked. |
| There is no communication from the PC to the IPC FED Compact via the serial interface. | - Make sure that the cable PS1 SM14 on the FEC-side is connected to the communication interface (COM) and not to the extension interface (EXT).  
- It is not permissible for any other programs from your PC to access the serial interface. |
### Fault finding

<table>
<thead>
<tr>
<th>Fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The power LED is not illuminated although the voltage is connected.</td>
<td>- You should check whether the voltage is 24 V DC (not AC).</td>
</tr>
<tr>
<td></td>
<td>- Check whether you have correctly connected +24 V DC and 0 V.</td>
</tr>
<tr>
<td></td>
<td>- You should check whether the wires are correctly stripped.</td>
</tr>
<tr>
<td>The connection to the IPC FEC Compact is not taking place.</td>
<td>- Check whether the IPC FEC is connected to voltage and the power LED is illuminated.</td>
</tr>
<tr>
<td></td>
<td>- You should check whether the programming cable SM14 on the IPC FEC Compact is plugged into the COM connection.</td>
</tr>
<tr>
<td></td>
<td>- Check whether the programming cable SM14 on the programming PC is plugged into a vacant RS232 connection and whether the correct connection is set in FST or Multiprog. (COM1, COM2 ...).</td>
</tr>
<tr>
<td></td>
<td>- You should check whether 9600 Baud 8/N/1 is set.</td>
</tr>
<tr>
<td></td>
<td>- Check whether the controller is suitable for the programming software used.</td>
</tr>
<tr>
<td>COM of FC2X</td>
<td>- Check that the programming PC achieves the I/O guaranteed minimum level in accordance with RS232-C.</td>
</tr>
</tbody>
</table>
5. Fault finding

<table>
<thead>
<tr>
<th>Fault</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The IPC FEC Compact does not react when the voltage supply is</td>
<td>The supply voltage is less than 18 V.</td>
</tr>
<tr>
<td>switched on. The TP LED is illuminated, power and the run LED are</td>
<td>– Use a power pack that supplies 24 V. In the case of laboratory</td>
</tr>
<tr>
<td>off.</td>
<td>power packs, the current limiter may be activated.</td>
</tr>
<tr>
<td>The project is correctly loaded, but the Run LED is illuminated</td>
<td>FST only:</td>
</tr>
<tr>
<td>red after the program is loaded.</td>
<td>– You should check whether the program 0 is installed in the project.</td>
</tr>
<tr>
<td></td>
<td>– Check whether the Program 0 has been highlighted in the project.</td>
</tr>
<tr>
<td></td>
<td>– Check whether the FST is actually loaded or whether an error</td>
</tr>
<tr>
<td></td>
<td>message is displayed in the message window.</td>
</tr>
<tr>
<td></td>
<td>– The error number (Online Control Panel menu) should be checked and</td>
</tr>
<tr>
<td></td>
<td>compared with the FST manual.</td>
</tr>
</tbody>
</table>

Fig. 5/1: Error number display
A. Technical Appendix

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A.1 Technical data .................................................. A-3
A.2 Output performance with overload/short circuit of the FC30 / FC34 .... A-12
A.3 Schematic circuit diagram of transistor outputs .................. A-13
A.4 Schematic circuit diagrams of relay outputs ...................... A-14
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### A.1 Technical data

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<th>General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Dimensions IPC FEC FC20 / FC22 / FC23 / FC30 / FC34</td>
<td>130 x 80 x 35 mm (W x H x D)</td>
</tr>
<tr>
<td>Dimensions IPC FEC FC21 / FC23</td>
<td>130 x 80 x 60 mm (W x H x D)</td>
</tr>
<tr>
<td>Weight IPC FEC FC20</td>
<td>160 g</td>
</tr>
<tr>
<td>Weight IPC FEC FC21</td>
<td>330 g</td>
</tr>
<tr>
<td>Weight IPC FEC FC22</td>
<td>160 g</td>
</tr>
<tr>
<td>Weight IPC FEC FC23</td>
<td>330 g</td>
</tr>
<tr>
<td>Weight IPC FEC FC30</td>
<td>160 g</td>
</tr>
<tr>
<td>Weight IPC FEC FC34</td>
<td>160 g</td>
</tr>
<tr>
<td>Sensitivity test for vibration (EN 60068-2-6 FC)</td>
<td>10-57 Hz 0.075 mm; 57 - 150 Hz 1 g</td>
</tr>
<tr>
<td>Sensitivity test for shock (EN 60068-2-27 EA)</td>
<td>15 g, 11 ms; 2 shocks/direction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Climatic characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport/storage (to IEC 68-2-1/2)</td>
<td>-25 °C to +70 °C</td>
</tr>
<tr>
<td>Normal operation (to IEC 68-2-1/2)</td>
<td>0 °C to +55 °C</td>
</tr>
<tr>
<td>Temperature change (gradual change)</td>
<td>IEC 68-2-14</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>95 % no moisture condensation</td>
</tr>
<tr>
<td>Dry heat and cold resistance test (EN 60068-2-2Bb / 2-1)</td>
<td>+70 °C, 96 h; -25 °C, 96 h</td>
</tr>
<tr>
<td>Temperature change resistance test (IEC 60068-2-14 Na/Nb)</td>
<td>-25 °C / +70 °C, 2 cycles every 3 h</td>
</tr>
<tr>
<td>Damp heat cycles resistance test (95-100 %) EN 60068-2-30Db</td>
<td>+25 °C / +55 °C, 2 cycles every 12 h</td>
</tr>
</tbody>
</table>
### General

<table>
<thead>
<tr>
<th>Electromagnetic characteristics</th>
<th>EN 50081-2 / EN 61000-6-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic compatibility (EMCG)</td>
<td>EN 61000-4-2</td>
</tr>
<tr>
<td>Electrostatic discharge (ESD)</td>
<td>EN 61000-4-3</td>
</tr>
<tr>
<td>High frequency electromagnetic fields (HFF)</td>
<td>EN 61000-4-4</td>
</tr>
<tr>
<td>Fast transients (bursts)</td>
<td>EN 61000-4-5</td>
</tr>
<tr>
<td>Transient voltage (FC21, FC23)</td>
<td>EN 61000-4-6</td>
</tr>
<tr>
<td>Conducted interference</td>
<td>EN 61000-4-7</td>
</tr>
<tr>
<td>Voltage drop/failure (FC21, FC23)</td>
<td>EN 61000-4-11</td>
</tr>
<tr>
<td>Radio interference voltage / interference field strength</td>
<td>EN 55011 / Class A</td>
</tr>
</tbody>
</table>

### Electrical characteristics

<table>
<thead>
<tr>
<th>In/Out connection</th>
<th>Screw terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal cross section</td>
<td>2 x 0.75 mm²</td>
</tr>
<tr>
<td>Tightening torque of screws (screw terminals)</td>
<td>max. 0.5 Nm</td>
</tr>
</tbody>
</table>

**Power supply for FC20, FC22**
- Voltage 24 V DC +25 %/-15 %
- Current consumption at 24 V, max. 200 mA
- Starting current at 30 V, T₄₀₀₀ms (10 ms)
- Circuit interruption time ≤1ms
- Cable length max. 10 m

**Power supply for FC21, FC23**
- Voltage 110 V to 230 V+ 10 %/-15 %
- Current consumption at 230 V AC, max. 40 mA
- Starting current at 230 V AC, T₄₀₀₀ms (10 ms)
- Circuit interruption time ≤1ms

**Power supply for FC30 and FC34**
- Voltage 24 V DC +25 %/-15 %
- Current consumption at 24 V, max. 180 mA
- Starting current at 30 V, T₄₀₀₀ms (10 ms)
- Circuit interruption time ≤1ms
- Cable length max. 10 m
### Digital inputs

<table>
<thead>
<tr>
<th></th>
<th>12 / 2 groups of 1 x 4 inputs, 1 x 8 inputs; both groups electrically isolated. The inputs of one group can be installed either current sinking or current sourcing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of which usable as fast counters</td>
<td>2, each max. 2 kHz</td>
</tr>
<tr>
<td>Input voltage/current</td>
<td>24 V DC, typ. 7 mA; type 1 ¹)</td>
</tr>
<tr>
<td>Nominal value for TRUE</td>
<td>15 V DC min.</td>
</tr>
<tr>
<td>Nominal value for FALSE</td>
<td>5 V DC max.</td>
</tr>
<tr>
<td>Input signal delay</td>
<td>Typ. 5 ms</td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>Yes, optocoupler</td>
</tr>
<tr>
<td>Status display via LED</td>
<td>ja</td>
</tr>
<tr>
<td>Incremental encoder</td>
<td>max. 200 Hz</td>
</tr>
<tr>
<td>Permissible length of connecting cable</td>
<td>max. 30 m</td>
</tr>
<tr>
<td>Dielectric strength against internal system voltages</td>
<td>Rated voltage of insulation 50 V AC</td>
</tr>
</tbody>
</table>

¹) The input voltages are to be generated from circuits to protection classification III; this requirement is met if the sensor supply voltage is used.
## Digital outputs

### Transistor outputs (FC30, FC34)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchable voltages / currents</td>
<td>+24 V DC + 20 % / - 15 %; Nominal current / outputs 0.6 A; short-circuit-proof / overload-proof</td>
</tr>
<tr>
<td>Lamp load</td>
<td>max. 5 W</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>max. 1 kHz</td>
</tr>
<tr>
<td>Maximum group current</td>
<td>3.2 A</td>
</tr>
<tr>
<td>Dielectric strength against internal system</td>
<td>Supply voltage with protective separation of mains voltage; rated voltage of insulation 50 V AC</td>
</tr>
<tr>
<td>voltage</td>
<td></td>
</tr>
<tr>
<td>Status display with LED</td>
<td>ja</td>
</tr>
<tr>
<td>Fuse protection</td>
<td>10 ampere quick-acting common for the 6 transistor outputs</td>
</tr>
<tr>
<td>Permissible length of connecting cable</td>
<td>max. 30 m</td>
</tr>
</tbody>
</table>

### Relay outputs: (FC20, FC21, FC34)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchable voltages / currents</td>
<td>5A/250 V AC, 5A/30 V DC, Minimum load: 10 mA bei 5 V DC</td>
</tr>
<tr>
<td>Minimum load</td>
<td></td>
</tr>
<tr>
<td>Switching frequency</td>
<td>Max. 25 Hz</td>
</tr>
<tr>
<td>Service life</td>
<td>100 000 switching cycles</td>
</tr>
<tr>
<td>Dielectric strength against internal system</td>
<td>Overvoltage category II mains voltage can be switched; rated voltage of insulation 300 V AC</td>
</tr>
<tr>
<td>voltage</td>
<td></td>
</tr>
<tr>
<td>Status display with LED</td>
<td>Yes</td>
</tr>
<tr>
<td>Fuse protection</td>
<td>None</td>
</tr>
<tr>
<td>Permissible length of connecting cable</td>
<td>Max. 30 m</td>
</tr>
</tbody>
</table>

### Solid state relay (FC22, FC23)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchable voltages / currents</td>
<td>3 to 264 V AC, 3 to 125 V DC; 0.1 to 600 mA</td>
</tr>
<tr>
<td>Switching frequency</td>
<td>Max. 10 Hz</td>
</tr>
</tbody>
</table>
### Digital outputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric strength against internal system voltage</td>
<td>Overload category II mains voltages can be switched; rated voltage of insulation 300 V AC</td>
</tr>
<tr>
<td>Short-circuit-proof/overload-proof</td>
<td>No</td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>Yes</td>
</tr>
<tr>
<td>Electrical isolation in groups</td>
<td>Yes, one group with 4 relays, two groups with 2 relays each</td>
</tr>
<tr>
<td>Status display with LED</td>
<td>Yes</td>
</tr>
<tr>
<td>Fuse protection</td>
<td>None</td>
</tr>
<tr>
<td>Permissible length of connecting cable</td>
<td>Max. 30 m</td>
</tr>
</tbody>
</table>

### Analogue potentiometer

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Range of values</td>
<td>1 - 63</td>
</tr>
</tbody>
</table>

### Serial interface COM

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Connection (FC20, FC21, FC22, FC23)</td>
<td>RJ11 socket</td>
</tr>
<tr>
<td>Connection (FC30, FC34)</td>
<td>RJ12 socket</td>
</tr>
<tr>
<td>Characteristic (FC20, FC21, FC22, FC23)</td>
<td>Serial, asynchronous, electrically isolated RS232C</td>
</tr>
<tr>
<td>Characteristic (FC30, FC34)</td>
<td>Serial, asynchronous, TTL level not electrically isolated RS232C</td>
</tr>
<tr>
<td>Use as RS232C (FC20, FC21, FC22, FC23)</td>
<td>KSD2 cable required</td>
</tr>
<tr>
<td>Use as RS232C (FC30, FC34)</td>
<td>SM14 or SM15 required</td>
</tr>
<tr>
<td>Use as programming interface</td>
<td>9600 Baud, 8/N/1</td>
</tr>
<tr>
<td>Use as universal interface (FC30, FC34 only)</td>
<td>300 to 115000 Baud, 7N1, 7E1, 701, 8N1, 8E1, 801</td>
</tr>
<tr>
<td><strong>Serial interface EXT</strong></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Quantity</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>RJ12 socket</td>
</tr>
<tr>
<td><strong>Characteristic</strong></td>
<td>Serial, asynchronous, TTL level not electrically isolated; RS232C</td>
</tr>
<tr>
<td><strong>Use as RS232C</strong></td>
<td>SM14 or SM15 required</td>
</tr>
<tr>
<td><strong>Pin allocation SM14/15</strong></td>
<td>Transmit, receive, RTS, CTS</td>
</tr>
<tr>
<td>**Use as universal interface <strong>1)</strong></td>
<td>300 to 115000 Baud, 7N1, 7E1, 7O1, 8N1, 8E1, 8O1</td>
</tr>
<tr>
<td><strong>Permissible length of connecting cable</strong></td>
<td>FEC SM14/15 + ZK14</td>
</tr>
</tbody>
</table>

*1) Depending on the programming system used different parameters can be used.

For further information, see the relevant description on the FST or MWT CD.
### A. Technical Appendix

<table>
<thead>
<tr>
<th>Ethernet (FC34 only)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Bus interface</strong></td>
<td>IEEE802.3 (10Base T)</td>
</tr>
<tr>
<td><strong>Data transfer rate</strong></td>
<td>10 Mbit/s</td>
</tr>
<tr>
<td><strong>Connector plug</strong></td>
<td>RJ45</td>
</tr>
<tr>
<td><strong>Supported protocols</strong></td>
<td>TCP/IP, EasyIP, http (FST only)</td>
</tr>
<tr>
<td><strong>OPC Server (available on request)</strong></td>
<td>Yes for EasyIP</td>
</tr>
<tr>
<td><strong>DDE server</strong></td>
<td>Yes for EasyIP</td>
</tr>
<tr>
<td><strong>Permissible length of connecting cable</strong></td>
<td>Max. 100 m up to next neutral point</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Status display</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power LED</strong></td>
<td>Operating voltage display - green</td>
</tr>
<tr>
<td><strong>Status LED</strong></td>
<td>According to status</td>
</tr>
<tr>
<td>Run</td>
<td>Green</td>
</tr>
<tr>
<td>Stop</td>
<td>Orange</td>
</tr>
<tr>
<td>Error</td>
<td>Red</td>
</tr>
<tr>
<td><strong>Traffic LED (Ethernet only FC34)</strong></td>
<td>Traffic: LED flashing - green</td>
</tr>
</tbody>
</table>
### Safety specifications

<table>
<thead>
<tr>
<th>Protection classification</th>
<th></th>
</tr>
</thead>
</table>
| IPC FEC 20, FC21, FC22, FC23 | Protection classification II  
Beyond this, with circuits which must be supplied with power supply units to IEC 742 / EN60742 / VDE 0551 / PELV with a minimum dielectric strength of 4 kV or with power supply units with a protective separation according to EN 60950 / VDE 0805. |
| IPC FEC FC30, FC34 | Protection classification III  
Power supply units to IEC 742/EN 60742/VDE 0551/PELV with a minimum dielectric strength of 4 kV switch power packs with a protective separation according to EN 60950/VDE 0805. When switching from "non PELV circuits" via the relay outputs, the overall configuration is to be allotted protection classification II.  
The maximum permissible length of the power supply cable is 10 m |

### Hardware and software characteristics

<table>
<thead>
<tr>
<th>Processor</th>
<th>80 186-(20 MHz)</th>
</tr>
</thead>
</table>
| Program memory with FC20/ FC21 / FC22 / FC23 | 256 k byte available  
(write/erase cycles min. 10,000) |
| Program memory with FC30 / FC34 | 512 k byte available  
(write/erase cycles min. 10,000) |
| Main memory with FC20 / FC21 / FC22 / FC23 | 256kB RAM  
typ. 3,500 lines STL |
| Main memory with FC 30 FST / FC 34 FST | typ. 14,000 lines STL |
| Main memory with FC30 MWT / FC 34 MWT | typ. 12,000 lines STL |
| Retentive data | Max 2 kByte in Flash |
| Terminal connection with FC20, FC21, FC22, FC23 | RS 232 wire 9600 baud (R) 11 mini connection |
| Terminal connection FC30 / FC34 | Serial asynchronous TL (R) 12 connection |
A.2 Output performance with overload/short-circuit of the FC30 / FC34

The transistor outputs (out 0.2 to out 0.7) are independently short-circuit and overload-proof.

In the event of a short-circuit or overload current, the temperature of the switching transistor rises. The overtemperature protection switches off the respective output to enable the switching transistor to cool down again. The respective output is then re-activated. The process is repeated anew. If an overload current is still applied following re-activation

The duration of the process cycle depends on the magnitude of the overload. In the case of merely minor overload, the cycle duration may last up to several minutes and in the case of high overload less than 2 seconds.
A.3 Schematic circuit diagram of transistor outputs

Fig. A/1: Transistor outputs FC30 / 34

1 Internal
2 External
3 Voltage supply
4 Actuator
5 Status LED
6 Analogue current limiting to 4A / fuse 10 ampere, common quick-acting for all outputs
A.4 Schematic circuit diagrams of relay outputs

Fig. A/2: Relay outputs on FC30 / 34
A. Technical Appendix

1. Internal
2. External
3. Load supply
4. Actuator
5. Relay contact max 250 V AC / 5A or 30 V DC / 5A
6. Relay coil
7. Status LED

Fig. A/3: Relay outputs on FC20/FC21
A.5  Schematic circuit diagram of solid state relay outputs

Fig. A/4: Solid state relay outputs FC22 / FC23
A. Technical Appendix

A.6 Schematic circuit diagram of digital inputs

Fig. A/5: Digital input, current sinking (PNP)

1 Internal
2 External
3 Voltage supply
4 Sensor
A. Technical Appendix

Fig. A/6: Digital input, current sourcing (NPN)
Accessories

Appendix B
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<th>Page</th>
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<tr>
<td>B.1 Accessories – detailed information</td>
<td>B-3</td>
</tr>
</tbody>
</table>
B.1 Accessories – detailed information

<table>
<thead>
<tr>
<th>Product</th>
<th>Product illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PS1 PSE3</strong> AC/DC converter 230 V AC/ 40 W, 24 V DC / 1.74 A</td>
<td><img src="image" alt="PS1 PSE3 AC/DC converter" /></td>
</tr>
<tr>
<td>24 V DC, 40 W is supplied by the PSE3 from 185 to 265 V AC - can be clipped on top-hat rail, suitable for PS1 design, Supplied with screw-in plugs</td>
<td></td>
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<tr>
<td>Packaging unit: 1 item</td>
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<tr>
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| Programming cable **PS1 SM14** | ![Programming cable](image) |
| Programming cable TTL-RS232 in SUB-D housing + null modem cable | |
| Packaging unit: 1 item         |                      |
| Order No. 188935               |                      |

<p>| Interface converter <strong>PS1 SM15</strong> | <img src="image" alt="Interface converter" /> |
| Interface converter TTL-RS232 in SUB-D housing + top-hat rail fixture with earth connection | |
| Packaging unit: 1 item          |                      |
| Order No. 192681                |                      |</p>
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<td><strong>FEC KSD2</strong> PC progr.-/com. cable (150 cm long)</td>
<td><img src="image" alt="FEC KSD2 Cable" /></td>
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<tr>
<td>RJ11/SUB D 9-pin</td>
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<td>Packaging unit 1 item</td>
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<td>Order No.: 177431</td>
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<td>Order No.: 191440</td>
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