WAGO-I/O-SYSTEM 750

753-649
M-Bus Master Module
for the Connection of M-Bus Devices

Version 1.1.2
Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

E-Mail: documentation@wago.com

We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present manual are generally protected by trademark or patent.

WAGO is a registered trademark of WAGO Verwaltungsgesellschaft mbH.
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1 Notes about this Documentation

Note

Always retain this documentation!
This documentation is part of the product. Therefore, retain the documentation during the entire service life of the product. Pass on the documentation to any subsequent user. In addition, ensure that any supplement to this documentation is included, if necessary.

1.1 Validity of this Documentation

This documentation is only applicable to the I/O module 753-649 (M-Bus Master Module).

The I/O module 753-649 shall only be installed and operated according to the instructions in this manual and in the manual for the used fieldbus coupler or controller.

NOTICE

Consider power layout of the WAGO-I/O-SYSTEM 750!
In addition to these operating instructions, you will also need the manual for the used fieldbus coupler or controller, which can be downloaded at www.wago.com. There, you can obtain important information including information on electrical isolation, system power and supply specifications.

1.2 Copyright

This Manual, including all figures and illustrations, is copyright-protected. Any further use of this Manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g., photocopying) as well as any amendments require the written consent of WAGO Kontakttechnik GmbH & Co. KG, Minden, Germany. Non-observance will involve the right to assert damage claims.
1.3 Symbols

**DANGER**

**Personal Injury!**
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

**DANGER**

**Personal Injury Caused by Electric Current!**
Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

**Personal Injury!**
Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

**Personal Injury!**
Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**NOTICE**

**Damage to Property!**
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

**NOTICE**

**Damage to Property Caused by Electrostatic Discharge (ESD)!**
Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

**Note**

**Important Note!**
Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.
Information

Additional Information:
Refers to additional information which is not an integral part of this documentation (e.g., the Internet).
1.4 Number Notation

Table 1: Number Notation

<table>
<thead>
<tr>
<th>Number Code</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal</td>
<td>100</td>
<td>Normal notation</td>
</tr>
<tr>
<td>Hexadecimal</td>
<td>0x64</td>
<td>C notation</td>
</tr>
<tr>
<td>Binary</td>
<td>'100'</td>
<td>In quotation marks, nibble separated with dots (.)</td>
</tr>
<tr>
<td></td>
<td>'0110.0100'</td>
<td></td>
</tr>
</tbody>
</table>

1.5 Font Conventions

Table 2: Font Conventions

<table>
<thead>
<tr>
<th>Font Type</th>
<th>Indicates</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>italic</em></td>
<td>Names of paths and data files are marked in italic-type.</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>C:\Program Files\WAGO Software</em></td>
</tr>
<tr>
<td>Menu</td>
<td>Menu items are marked in bold letters.</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>Save</em></td>
</tr>
<tr>
<td>&gt;</td>
<td>A greater-than sign between two names means the selection of a menu item from a menu.</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>File &gt; New</em></td>
</tr>
<tr>
<td>Input</td>
<td>Designation of input or optional fields are marked in bold letters,</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>Start of measurement range</em></td>
</tr>
<tr>
<td>&quot;Value&quot;</td>
<td>Input or selective values are marked in inverted commas.</td>
</tr>
<tr>
<td></td>
<td>e.g.: Enter the value &quot;4 mA&quot; under <em>Start of measurement range.</em></td>
</tr>
<tr>
<td>[Button]</td>
<td>Pushbuttons in dialog boxes are marked with bold letters in square brackets.</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>[Input]</em></td>
</tr>
<tr>
<td>[Key]</td>
<td>Keys are marked with bold letters in square brackets.</td>
</tr>
<tr>
<td></td>
<td>e.g.: <em>[F5]</em></td>
</tr>
</tbody>
</table>
2 Important Notes

This section includes an overall summary of the most important safety requirements and notes that are mentioned in each individual section. To protect your health and prevent damage to devices as well, it is imperative to read and carefully follow the safety guidelines.

2.1 Legal Bases

2.1.1 Subject to Changes

WAGO Kontakttechnik GmbH & Co. KG reserves the right to provide for any alterations or modifications. WAGO Kontakttechnik GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

2.1.2 Personnel Qualifications

All sequences implemented on WAGO-I/O-SYSTEM 750 devices may only be carried out by electrical specialists with sufficient knowledge in automation. The specialists must be familiar with the current norms and guidelines for the devices and automated environments.

All changes to the coupler or controller should always be carried out by qualified personnel with sufficient skills in PLC programming.

2.1.3 Use of the 750 Series in Compliance with Underlying Provisions

Fieldbus couplers, controllers and I/O modules found in the modular WAGO-I/O-SYSTEM 750 receive digital and analog signals from sensors and transmit them to actuators or higher-level control systems. Using controllers, the signals can also be (pre-) processed.

The devices have been developed for use in an environment that meets the IP20 protection class criteria. Protection against finger injury and solid impurities up to 12.5 mm diameter is assured; protection against water damage is not ensured. Unless otherwise specified, operation of the devices in wet and dusty environments is prohibited.

Operating the WAGO-I/O-SYSTEM 750 devices in home applications without further measures is only permitted if they meet the emission limits (emissions of interference) according to EN 61000-6-3. You will find the relevant information in the section “Device Description” > “Standards and Guidelines” in the manual for the used fieldbus coupler or controller.

Appropriate housing (per 2014/34/EU) is required when operating the WAGO-I/O-SYSTEM 750 in hazardous environments. Please note that a
prototype test certificate must be obtained that confirms the correct installation of
the system in a housing or switch cabinet.

The implementation of safety functions such as EMERGENCY STOP or safety
door monitoring must only be performed by the F I/O modules within the modular
WAGO-I/O-SYSTEM 750. Only these safe F I/O modules ensure functional
safety in accordance with the latest international standards. WAGO's
interference-free output modules can be controlled by the safety function.

2.1.4 Technical Condition of Specified Devices

The devices to be supplied ex works are equipped with hardware and software
configurations, which meet the individual application requirements. These
modules contain no parts that can be serviced or repaired by the user. The
following actions will result in the exclusion of liability on the part of WAGO
Kontakttechnik GmbH & Co. KG:

• Repairs,
• Changes to the hardware or software that are not described in the
  operating instructions,
• Improper use of the components.

Further details are given in the contractual agreements. Please send your
request for modified and new hardware or software configurations directly to
WAGO Kontakttechnik GmbH & Co. KG.
2.2 Safety Advice (Precautions)

For installing and operating purposes of the relevant device to your system the following safety precautions shall be observed:

**DANGER**

Do not work on devices while energized!
All power sources to the device shall be switched off prior to performing any installation, repair or maintenance work.

**DANGER**

Install device in only one suitable enclosure!
The device is an open system. Install the device in a suitable enclosure. This enclosure must:

- Guarantee that the max. permissible degree of pollution is not exceeded.
- Offer adequate protection against contact.
- Prevent fire from spreading outside of the enclosure.
- Offer adequate protection against UV irradiation.
- Guarantee mechanical stability
- Restrict access to authorized personnel and may only be opened with tools

**DANGER**

Ensure disconnect and overcurrent protection!
The device is intended for installation in automation technology systems. Disconnect protection is not integrated. Connected systems must be protected by a fuse.
Provide suitable disconnect and overcurrent protection on the system side!

**DANGER**

Ensure a standard connection!
To minimize any hazardous situations resulting in personal injury or to avoid failures in your system, the data and power supply lines shall be installed according to standards, with careful attention given to ensuring the correct terminal assignment. Always adhere to the EMC directives applicable to your application.
Use SELV power source only!
The fieldbus coupler/controller must only be powered from a SELV (Safety Extra Low Voltage) power source.

Replace defective or damaged devices!
Replace defective or damaged device/module (e.g., in the event of deformed contacts).

Protect the components against materials having seeping and insulating properties!
The components are not resistant to materials having seeping and insulating properties such as: aerosols, silicones and triglycerides (found in some hand creams). If you cannot exclude that such materials will appear in the component environment, then install the components in an enclosure being resistant to the above-mentioned materials. Clean tools and materials are imperative for handling devices/modules.

Clean only with permitted materials!
Clean housing and soiled contacts with propanol.

Do not use any contact spray!
Do not use any contact spray. The spray may impair contact area functionality in connection with contamination.

Avoid reverse polarity!
Avoid reverse polarity of the power supply lines, as this may damage the devices involved.
Avoid electrostatic discharge!
The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. Please observe the safety precautions against electrostatic discharge per DIN EN 61340-5-1/-3. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly grounded.
3 Device Description

The M-Bus master 753-649 acts as a master in M-Bus communication systems, allowing M-Bus slaves to be directly connected to the WAGO-I/O-SYSTEM 750 with a two-wire interface per EN 13757.

The M-Bus master communicates with the M-Bus slaves via the M-Bus protocol and forms the interface between the M-Bus network and the processing software. When queried, the M-Bus master transmits control commands to actuators via the two-wire cable or reads data from consumption meters and sensors. The data recorded is passed on to the higher-level controller for further processing or visualization.

PLC queries can be implemented via the PLC using IEC 61131-3 function blocks or via a PC application.

The M-Bus slaves are powered via the M-bus master. The use of a separate level converter is not required.

Both signal transmission and operating status, as well as trouble-free local bus communication, are indicated via one-color and multicolor LEDs.
The I/O module 753-649 can be operated on the following fieldbus controllers of the WAGO-I/O-SYSTEM 750 from the specified firmware revision level:

<table>
<thead>
<tr>
<th>Bus System</th>
<th>Fieldbus Coupler/Controller</th>
<th>Item Number</th>
<th>Firmware Revision Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>Controller</td>
<td>750-852</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-880</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-881</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-882</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-885</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td>BA application controller</td>
<td>750-884</td>
<td>07</td>
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<tr>
<td></td>
<td>PFC100 fieldbus controller</td>
<td>750-8100</td>
<td>09</td>
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<tr>
<td></td>
<td></td>
<td>750-8101</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-8102</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td>PFC200 fieldbus controller</td>
<td>750-8202</td>
<td>08</td>
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<tr>
<td></td>
<td></td>
<td>750-8203</td>
<td>08</td>
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<tr>
<td></td>
<td></td>
<td>750-8204</td>
<td>08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-8206</td>
<td>08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-8207</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>750-8208</td>
<td>09</td>
</tr>
<tr>
<td>KNX</td>
<td>Controller</td>
<td>750-889</td>
<td>09</td>
</tr>
<tr>
<td>Modbus®</td>
<td>I/O-IPC</td>
<td>758-874/000-xxx</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>758-875/000-xxx</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>758-876/000-xxx</td>
<td>09</td>
</tr>
<tr>
<td>BACnet</td>
<td>Controller</td>
<td>750-829</td>
<td>07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>750-831</td>
<td>07</td>
</tr>
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</table>
3.1 View

Figure 1: View of Device

Table 4: Legend for Figure “View”

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Details See Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Marking possibility with Mini-WSB</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>Status-LEDs</td>
<td>“Device Description” &gt; “Display Elements”</td>
</tr>
<tr>
<td>3</td>
<td>Data contacts</td>
<td>“Device Description” &gt; “Connectors”</td>
</tr>
<tr>
<td>4</td>
<td>CAGE CLAMP® connectors</td>
<td>“Device Description” &gt; “Connectors”</td>
</tr>
<tr>
<td>5</td>
<td>Pull tab</td>
<td>“Mounting” &gt; “I/O Modules with Pluggable Wiring Level (Series 753)”</td>
</tr>
<tr>
<td>6</td>
<td>Coding possibility with coding fingers</td>
<td>“Mounting” &gt; “Coding”</td>
</tr>
<tr>
<td>7</td>
<td>Power jumper contacts</td>
<td>“Device Description” &gt; “Connectors”</td>
</tr>
<tr>
<td>8</td>
<td>Test port</td>
<td>---</td>
</tr>
<tr>
<td>9</td>
<td>Fixing lug for cable ties</td>
<td>“Mounting” &gt; “I/O Modules with Pluggable Wiring Level (Series 753)”</td>
</tr>
</tbody>
</table>
3.2 Connectors

3.2.1 Data Contacts/Local Bus

Communication between the fieldbus coupler/controller and the I/O modules as well as the system supply of the I/O modules is carried out via the local bus. The contacting for the local bus consists of 6 data contacts, which are available as self-cleaning gold spring contacts.

Figure 2: Data Contacts

---

**NOTICE**

Do not place the I/O modules on the gold spring contacts!

Do not place the I/O modules on the gold spring contacts in order to avoid soiling or scratching!

---

**NOTICE**

Pay attention to potential equalization from the environment!

The devices are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the devices, please ensure that environmental factors (personnel, work space and packaging) are properly equalized. Do not touch any conducting parts, e.g., data contacts.
3.2.2 Power Jumper Contacts/Field Supply

⚠️ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury. Do not touch the blade contacts.

The I/O module 753-649 has 2 self-cleaning power jumper contacts that supply and transmit power for the field side. The contacts on the left side of the I/O module are designed as blade contacts and those on the right side as spring contacts.

![Image 1](image1.png)

Figure 3: Power Jumper Contacts

<table>
<thead>
<tr>
<th>Contact</th>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring contact</td>
<td>Potential transmission ((U_v)) for field supply</td>
</tr>
<tr>
<td>2</td>
<td>Spring contact</td>
<td>Potential transmission ((0, V)) for field supply</td>
</tr>
<tr>
<td>3</td>
<td>Blade contact</td>
<td>Potential feed-in ((0, V)) for field supply</td>
</tr>
<tr>
<td>4</td>
<td>Blade contact</td>
<td>Potential feed-in ((U_v)) for field supply</td>
</tr>
</tbody>
</table>

Do not exceed maximum values via power contacts!
The maximum current that can flow through the power jumper contacts is 10 A. The power jumper contacts can be damaged and the permissible operating temperature can be exceeded by higher current values.

When configuring the system, do not exceed the permissible maximum current value. If there is a higher power requirement, you must use an additional supply module to provide the field voltage.
### 3.2.3 CAGE CLAMP® Connectors

![CAGE CLAMP® Connections Diagram](image)

**Table 6: Legend for Figure “CAGE CLAMP® Connections”**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>+M-Bus</td>
<td>Connection for M-Bus cable (positive), M-Bus power supply</td>
</tr>
<tr>
<td>−M-Bus</td>
<td>Connection for M-Bus cable (negative), M-Bus power supply</td>
</tr>
<tr>
<td>NC</td>
<td>Not assigned</td>
</tr>
<tr>
<td>FE</td>
<td>Functional ground</td>
</tr>
</tbody>
</table>

The CAGE CLAMP® outputs are short-circuit-protected.
### 3.3 Display Elements

#### Table 7: Legend for the Figure “Display Elements”

<table>
<thead>
<tr>
<th>LED</th>
<th>Designation</th>
<th>State</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Local bus communication status</td>
<td>Off</td>
<td>Not ready for operation, or no/faulty local bus communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>Ready for operation and uninterrupted local bus communication</td>
</tr>
<tr>
<td>B</td>
<td>TxD (data transmission)</td>
<td>Off</td>
<td>No data transmission via M-Bus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>Data transmission via M-Bus</td>
</tr>
<tr>
<td>C</td>
<td>Overcurrent</td>
<td>Off</td>
<td>No error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red</td>
<td>Overcurrent on M-Bus cables</td>
</tr>
<tr>
<td>D</td>
<td>Not used</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>Power supply status</td>
<td>Off</td>
<td>No field-side power supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green, steady</td>
<td>M-Bus master fault ¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green, flashing</td>
<td>Value of the external power supply voltage outside the permitted range</td>
</tr>
<tr>
<td>F</td>
<td>RxD (data receipt)</td>
<td>Off</td>
<td>No data receipt via M-Bus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green</td>
<td>Data receipt via M-Bus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orange</td>
<td>Telegram collision detected</td>
</tr>
<tr>
<td>G</td>
<td>M-Bus overload</td>
<td>Off</td>
<td>No error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red</td>
<td>Total consumption of the connected M-Bus slaves exceeds the available current strength.</td>
</tr>
<tr>
<td>H</td>
<td>Not used</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

¹ The LED may not light up until the first time a load is applied to the M-Bus master, even though the M-Bus master is ready for operation. In this case, the LED turns on as soon as a load is applied.
3.4 Operating Elements

The I/O module 753-649 does not have any electro-mechanical operating elements.

Changes to the configuration and parameters are made via the higher-order control.

3.5 Schematic Diagram

Figure 6: Schematic Circuit Diagram
3.6 Overcurrent Shutdown

Active current monitoring ensures short circuit resistance of the M-Bus master interface.

If the M-Bus current exceeds the threshold (see section “Technical Data” > … > “Communication”), the M-Bus master shuts down the M-Bus power to the CAGE CLAMP® connections.

The shutdown is signaled via an LED (see section “Device Description” > … > “Display Elements”).

After the minimum shutdown time passes, the M-Bus master attempts to turn the M-Bus power back on. If the M-Bus current threshold continues to be exceeded, the M-Bus power is shut down again. This process is repeated until the M-Bus current is below the threshold.

The following can cause the threshold to be exceeded:

- Short circuit on the M-Bus cables M+ and M−
- Telegram collision in which three or more M-Bus slaves respond simultaneously to a query from the M-Bus master
- Connected M-Bus cable is too long
3.7 Technical Data

3.7.1 Device Data

<table>
<thead>
<tr>
<th>Device Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>12 mm</td>
</tr>
<tr>
<td>Height (from upper edge of DIN-rail)</td>
<td>64 mm</td>
</tr>
<tr>
<td>Depth</td>
<td>100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>54 g</td>
</tr>
</tbody>
</table>

3.7.2 Power Supply

<table>
<thead>
<tr>
<th>Power Supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>Via system voltage (5 VDC)</td>
</tr>
<tr>
<td>Current consumption&lt;sub&gt;max&lt;/sub&gt; system supply</td>
<td>40 mA</td>
</tr>
<tr>
<td>Current consumption&lt;sub&gt;typ&lt;/sub&gt; system supply</td>
<td>35 mA</td>
</tr>
<tr>
<td>Current consumption&lt;sub&gt;max&lt;/sub&gt; field</td>
<td>130 mA</td>
</tr>
<tr>
<td>Current consumption&lt;sub&gt;typ&lt;/sub&gt; field</td>
<td>120 mA</td>
</tr>
<tr>
<td>System voltage field</td>
<td>24 VDC (−2.5 % ... +5 %)</td>
</tr>
<tr>
<td>Voltage via power jumper contacts</td>
<td>23.4 V ... 25.2 VDC</td>
</tr>
<tr>
<td>Current&lt;sub&gt;max&lt;/sub&gt; via power jumper contacts</td>
<td>10 A</td>
</tr>
</tbody>
</table>

Recommended power supplies:
- EPSITRON®CLASSIC family:
  - 1st generation 787-612
  - 2nd generation 787-1606
- EPSITRON®ECO family:
  - 787-1712
- EPSITRON®PRO family:
  - 787-818
- EPSITRON®COMPACT family:
  - 787-1002

Isolation | 500 V system/field level |
Cable type | 2-wire cable, shielded or unshielded |

---

**Note**

Power supply range deviating from IEC 61131

Note that the required tolerance and ripples of the power supply differ from the IEC 61131 standard.

The M-Bus voltage only corresponds to the M-Bus specification if it is within the defined power supply range of the M-Bus Master module.

Therefore, the specified power supply range must be complied with.
3.7.3 Communication

Table 10: Technical Data – Communication

<table>
<thead>
<tr>
<th>Transmission channels</th>
<th>1, bidirectional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal data width</td>
<td>24 bytes</td>
</tr>
<tr>
<td></td>
<td>(Mailbox 2.0 with 22-byte length)</td>
</tr>
<tr>
<td>Startup and configuration</td>
<td>WAGO-I/O-PRO V. 2.3, eCOCKPIT</td>
</tr>
<tr>
<td>Baud rates</td>
<td>• 9600 baud</td>
</tr>
<tr>
<td></td>
<td>• 2400 baud</td>
</tr>
<tr>
<td></td>
<td>• 300 baud</td>
</tr>
<tr>
<td>Cable length&lt;sub&gt;max.&lt;/sub&gt; (total network)</td>
<td>• up to 1000 m at 9600 baud ¹</td>
</tr>
<tr>
<td></td>
<td>• up to 2000 m at 2400 baud</td>
</tr>
<tr>
<td></td>
<td>• up to 6000 m at 300 baud</td>
</tr>
<tr>
<td>Master-to-slave distance&lt;sub&gt;max&lt;/sub&gt;</td>
<td>• up to 500 m at 9600 baud</td>
</tr>
<tr>
<td></td>
<td>• up to 1000 m at 2400 baud or 300 baud</td>
</tr>
<tr>
<td>M-Bus standard load&lt;sub&gt;max&lt;/sub&gt;</td>
<td>40 pcs, 1.5 mA each</td>
</tr>
</tbody>
</table>

Overcurrent shutdown

<table>
<thead>
<tr>
<th>Type of monitoring</th>
<th>Active current monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold</td>
<td>Approx. 120 mA (fixed setting)</td>
</tr>
<tr>
<td>Minimum shutdown time</td>
<td>500 ms</td>
</tr>
</tbody>
</table>

¹ With a conductor size of 1.5 mm², the maximum possible total line length is reduced to 500 m. The reason is higher discharge currents that can lead to an error message at lengths over 500 m.

3.7.4 Connection Type

Table 11: Technical Data – Wiring Level

<table>
<thead>
<tr>
<th>Connection technology</th>
<th>CAGE CLAMP&lt;sup&gt;®&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor cross-section</td>
<td>0.08 mm² … 1.5 mm² / 28 … 16 AWG</td>
</tr>
<tr>
<td>Strip length</td>
<td>8 mm … 9 mm / 0.33 in</td>
</tr>
</tbody>
</table>

Table 12: Technical Data – Power Jumper Contacts

| Power jumper contacts | Blade/spring contact, self-cleaning |

Table 13: Technical Data – Data Contacts

| Data contacts | Slide contact, hard gold plated, self-cleaning |
3.7.5 Climatic Environmental Conditions

Table 14: Technical Data – Climatic Environmental Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surrounding air temperature, operation</td>
<td>0 °C … 50 °C</td>
</tr>
<tr>
<td>Altitude above sea level</td>
<td>2000 m</td>
</tr>
<tr>
<td>Surrounding air temperature, storage</td>
<td>−20 °C … +85 °C</td>
</tr>
<tr>
<td>Storage altitude above sea level</td>
<td>3000 m</td>
</tr>
<tr>
<td>Relative humidity (without condensation)</td>
<td>10 % … 95 %</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP20</td>
</tr>
<tr>
<td>Exposure to pollutants</td>
<td>Per IEC 60068-2-42 and IEC 60068-2-43</td>
</tr>
<tr>
<td>Max. contaminant concentration at relative humidity &lt; 75 %</td>
<td>SO2 ≤ 25 ppm</td>
</tr>
<tr>
<td></td>
<td>H2S ≤ 10 ppm</td>
</tr>
<tr>
<td>Special conditions</td>
<td>The components may not be used without additional measures at locations in which dust, corrosive fumes, gases or ionizing radiation can occur.</td>
</tr>
</tbody>
</table>
3.8 Approvals

Information

More information about approvals.
Detailed references to the approvals are listed in the document “Overview Approvals WAGO-I/O-SYSTEM 750”, which you can find via the internet under: www.wago.com → DOWNLOADS → Documentation → System Description.

The following approvals have been granted to 753-649 I/O modules:

Conformity Marking
3.9 Standards and Guidelines

753-649 I/O modules meet the following requirements on emission and immunity of interference:

EMC CE-Immunity to interference EN 61000-6-2
EMC CE-Emission of interference EN 61000-6-3

**Note**

Use recommended power supplies for reliable CE immunity to interference and emission of interference compliance.

In order to comply reliably with the EMC standards indicated, use the recommended power supplies for supplying power to the M-Bus master. Operation may not be compliant with standards if different power supplies are used.
4 Process Image

The M-Bus master 753-649 has a cyclic 24 byte process image for the local bus. An acyclic channel that occupies 22 bytes of data is embedded in the process image for the process communication. The input and output data exchange is event-driven.

5 Mounting

5.1 Mounting Sequence

Fieldbus couplers, controllers and I/O modules of the WAGO-I/O-SYSTEM 750 are snapped directly on a carrier rail in accordance with the European standard EN 60175 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual devices are securely seated on the rail after installation.

Starting with the fieldbus coupler or controller, the I/O modules are mounted adjacent to each other according to the project design. Errors in the design of the node in terms of the potential groups (connection via the power contacts) are recognized, as the I/O modules with power contacts (blade contacts) cannot be linked to I/O modules with fewer power contacts.

⚠️ CAUTION

Risk of injury due to sharp-edged blade contacts!
The blade contacts are sharp-edged. Handle the I/O module carefully to prevent injury. Do not touch the blade contacts.

NOTICE

Insert I/O modules only from the proper direction!
All I/O modules feature grooves for power jumper contacts on the right side. For some I/O modules, the grooves are closed on the top. Therefore, I/O modules featuring a power jumper contact on the left side cannot be snapped from the top. This mechanical coding helps to avoid configuration errors, which may destroy the I/O modules. Therefore, insert I/O modules only from the right and from the top.

Note

Don't forget the bus end module!
Always plug a bus end module (750-600) onto the end of the fieldbus node! You must always use a bus end module at all fieldbus nodes with WAGO-I/O-SYSTEM 750 fieldbus couplers or controllers to guarantee proper data transfer.
5.2 Inserting and Removing Devices

**DANGER**

Do not work when devices are energized!
High voltage can cause electric shock or burns.
Switch off all power to the device prior to performing any installation, repair or maintenance work.

5.2.1 Inserting the I/O Module

1. Position the I/O module so that the tongue and groove joints to the fieldbus coupler or controller or to the previous or possibly subsequent I/O module are engaged.

![Figure 7: Insert I/O Module (Example)](image)

2. Press the I/O module into the assembly until the I/O module snaps into the carrier rail.

![Figure 8: Snap the I/O Module into Place (Example)](image)

With the I/O module snapped in place, the electrical connections for the data contacts and power jumper contacts (if any) to the fieldbus coupler or controller or to the previous or possibly subsequent I/O module are established.
5.2.2 Removing the I/O Module

**Note**

Remove pluggable wiring!
Before removing a 753 Series I/O Module from the node, you must first remove the plug (pluggable wiring) from the I/O module (see section “Plug Removal”)

1. Remove the I/O module from the node by pulling the tab.

![Figure 9: Removing the I/O Module (Example)]](image)

Electrical connections for data or power jumper contacts are disconnected when removing the I/O module.

5.3 I/O Modules with Pluggable Wiring Level (Series 753)

For wiring, a plug is plugged into the bottom of the module of all 753 Series I/O modules. The plug can be completely removed together with the wiring, simplifying replacement of defective modules from the assembly.

![Figure 10: Plug and I/O Module](image)

Miniature WSB marking tags ensure that the right plug is matched up with the right I/O module (see figure below).
5.3.1 Coding

Coding using small plastic pins and sockets facilitates mating of the I/O module with the appropriate plug.

1. Insert the pin into the socket.

2. Position the assembled coding fingers in the I/O module. Due to its design, each coding finger allows 4 different coding options (i.e.; 16 different options using 2 coding fingers).
3. Place the plug onto the I/O module.

4. When the plug is removed the sockets remain in the I/O module. The coded plug can only fit in the corresponding coded I/O module (see figures below).
5.3.2 Plug Removal

1. Remove the plug from the I/O module by pulling the orange pull tab on the plug toward the top of the I/O module.

![Pulling the Pull Tab](image1.png)

The plug detaches from the I/O module.

2. Alternatively, you can also use a standard screwdriver at the position shown (in the figure below) to remove the plug.

![Removing the Plug Using a Screwdriver](image2.png)
6 Connect Devices

6.1 Connecting a Conductor to the CAGE CLAMP®

The WAGO CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors.

**Note**

Only connect one conductor to each CAGE CLAMP®!
Only one conductor may be connected to each CAGE CLAMP®. Do not connect more than one conductor at one single connection!

If more than one conductor must be routed to one connection, these must be connected in an up-circuit wiring assembly, for example using WAGO feed-through terminals.

1. For opening the CAGE CLAMP® insert the actuating tool into the opening above the connection.

2. Insert the conductor into the corresponding connection opening.

3. For closing the CAGE CLAMP® simply remove the tool. The conductor is now clamped firmly in place.

Figure 20: Connecting a Conductor to a CAGE CLAMP®
6.2 Connection Example

Figure 21: Connection Example
6.3 Important Installation Notes

**DANGER**

Do not work when devices are energized!
High voltage can cause electric shock or burns.
Switch off all power to the device prior to performing any installation, repair or maintenance work.

6.3.1 Field Supply

**Note**

Observe tolerance range of the field supply
The correct function of the M-Bus interface is only ensured if the voltage of the field supply is in the range 23.4 VDC ... 25.2 VDC.

When continuously illuminated, LED E indicates that the supply voltage is in the permissible range. When LED E blinks, the supply voltage is outside the permissible range (see section “Device Description” > > … > “Display Elements”).

**Note**

Ensure stable power supply
Due to interference from other I/O modules or the use of power supplies with tolerances that are too high, the quality of the supply voltage may be insufficient, impairing the operation of the M-Bus master.
In that case, it is necessary to use an additional bus supply module and an additional appropriate power supply. The power supplies recommended for use with the M-Bus master are listed in the section “Technical Data” > “Power Supply”. 
6.3.2 M-Bus Cable

If shielded cables are used, the cable shielding should be placed on the FE connection of the M-Bus master.

The cabling of an M-Bus segment must meet the general requirements of standard EN 13757-2. For reliable communication, the following values are relevant and depend on each other in some cases:

- Total cable length: Sum of the lengths of all M-Bus cables connected to the M-Bus master
- Master-to-slave distance: Cable length between the master and the most distant slave
- Cable cross-section
- Baud rate

In general, the greater the cable length or the distance between the master and slave is, the lower the baud rate is. The supported combinations are given in the section “Technical Data” > “Communication.”

Excessive cable lengths can trigger the overcurrent shutdown (see section “Device Description” > “Overcurrent Shutdown”). Although larger cable cross-sections decrease the voltage drop on the M-Bus cable at large distances, they simultaneously increase the risk of triggering the overcurrent shutdown of the M-Bus master.

6.3.3 M-Bus Network

One network with up to 40 M-Bus standard loads can be connected to each M-Bus master and queried. If the permissible number of M-Bus standard loads is exceeded, the M-Bus master shuts down the power supply to the M-Bus slaves.

**NOTICE**

*Only connect M-Bus slaves*
Connecting additional M-Bus masters to the M-Bus master can lead to damage to the device. Only connect M-Bus members with slave characteristics to the M-Bus master.
7 Commissioning

7.1 Preparation

The 753-649 I/O module in the fieldbus node is powered via the power jumper contact. Use of an appropriate WAGO power supply is recommended for this purpose (see section “Technical Data” > “Power Supply”).

You have the following options for connecting the fieldbus node to the PC:

- Connecting the LAN interface of the fieldbus controller to an RJ45 cable
- Connecting the serial service port of the fieldbus controller to the 750-923 WAGO USB communication cable (available as an accessory)
- Connecting the serial service port of the fieldbus controller to the 750-921 WAGO Bluetooth® Adapter (available as an accessory)

In the example given here, the fieldbus node consists of the following WAGO-I/O-SYSTEM components:

Table 15: Example of a Fieldbus Node Setup

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>750-881</td>
<td>Programmable Fieldbus Controller ETHERNET (PLC)</td>
</tr>
<tr>
<td>753-649</td>
<td>M-Bus master module</td>
</tr>
<tr>
<td>750-600</td>
<td>End module</td>
</tr>
</tbody>
</table>

The fieldbus node is ready for use once the hardware of the fieldbus node and the M-Bus network is set up correctly and functions without errors:

- The M-Bus slaves are connected to the M+ and M− connections of the M-Bus master.
- At least one consumption meter is connected as the M-Bus slave.
- The fieldbus is connected to the PC.
- The network card of the PC is set according to the address range for the fieldbus node.
7.2 Configuration and Data Access

7.2.1 Configuration and Access via WAGO-I/O-PRO

For initial startup of the M-Bus master and configuration of the M-Bus network connected to it, you need the WAGO-I/O-PRO development environment (Item No.: 759-333).

---

**Note**

Download the M-Bus library free of charge

To create and use your own IEC application (CODESYS 2.3) you can download the “MBUS_649_01.lib” M-Bus library free of charge from the M-Bus website at:  
[www.wago.com](http://www.wago.com)

The data is accessed via the IEC function blocks of the M-Bus library. In the process, corresponding IEC function blocks such as Water, Electricity, Heat or Multi-meter, and the necessary master function blocks if applicable, are used for each M-Bus slave. If needed, each module can be given the desired address of the M-Bus slave.

If a function block sends a query to the corresponding meter, the meter supplies the queried data such as the manufacturer ID, serial number, medium and meter reading and provides it on the function block for further use or visualization.

---

**Note**

Parameterize response time of non-standards-compliant meters

The M-Bus master and the IEC function blocks are designed according to standard EN 13757 (two-wire bus) for operation with meters. According to this, the maximum response time of the M-Bus slaves is 22 bit times. Older meters may have longer response times, so it is necessary to parameterize the M-Bus master differently. In this case, adjust the parameterization via the function library.

---

**Note**

Download instructions for creating function blocks

You can find information on creating and using function blocks in the “MBus_649_01” application note, which you can download from the WAGO website free of charge at:  
[www.wago.com](http://www.wago.com)
7.2.2  Configuration and Access via MBSheet and MBCONF

For initial startup and maintenance of the M-Bus master and for various tasks such as automatic meter search, generating and editing the meter list and cyclic readout of meters, you can use the MBSheet and MBCONF software applications from Relay in connection with the M-Bus Connector and WAGO-I/O-CHECK software.

MBSheet is readout software for M-Bus slaves that follow standards EN 1434 and EN 13757.
MBCONF is service software that simplifies parameterization of individual M-Bus slaves.

**Note**

**Download MBSheet and MBCONF free of charge**
You can download the MBSheet and MBCONF software solutions provided by Relay Reinecke Elektronikentwicklung und Layout GmbH from the Relay website at:
www.relay.de
The installation package of the M-Bus Connector software already contains a version of MBSheet.

WAGO-I/O-CHECK makes it possible to open the user interface from MBSheet.

**Note**

**WAGO-I/O-CHECK Version 3.15 or higher necessary**
In order to use MBSheet, you need WAGO-I/O-CHECK, Version 3.15 or higher, which you can find in the WAGO eShop at:
www.wago.com
If you need an update for an earlier version of WAGO-I/O-CHECK, you can get it from WAGO customer support.

M-Bus Connector is software that provides a virtual COM port through which MBSheet is connected to WAGO-I/O-CHECK.
A version of the MBSheet software is supplied together with the M-Bus Connector software.

**Note**

**Download M-Bus Connector including MBSheet free of charge**
You can download the M-Bus Connector software with an included version of MBSheet from the WAGO website:
www.wago.com
7.2.2.1 Install Components

Install the software applications in the following order:

1. **WAGO-I/O-CHECK**
   Version 3.15 or higher is necessary.

2. **MBCONF**
   Installation is optional.

3. **M-Bus Connector with MBSheet**

   The first time you install M-Bus Connector, you receive a Windows security alert about the ELTIMA software during the installation process (see following figure). This software is a required device driver. Click "Install".

   ![Windows Security Alert about the Eltima Software](image)

   Figure 22: Windows Security Alert about the Eltima Software

   Before the installation of M-Bus Connector is completed, you receive a Windows alert containing the option “Start MBSheet Installation” (see following figure). This option is selected by default so the supplied version of MBSheet will be installed at the end of the installation. If a version of MBSheet already exists, this replaces it.

   It is necessary to install the German and English language packages for MBSheet to function properly. Use the “Complete” installation type. If you do not want to install the included version, uncheck the “Start MBSheet Installation” box.

   To finish the installation, click “Finish”.
Once all applications are installed, you can use MBSheet and MBCONF.
7.2.2.2 Open MBSheet

Proceed as follows in order to access MBSheet:

1. Open WAGO-I/O-CHECK.
2. If the Monitor or Control mode is activated in WAGO-I/O-CHECK, deactivate it. Click the corresponding button in the toolbar, so that it is no longer highlighted. This step is unnecessary if configuring for the first time.
3. Click the I/O module and then the Settings button.

Or:

Right-click on the I/O module and then click the Settings menu item (see the figure below).

![Figure24: Opening MBSheet via WAGO-I/O-CHECK](image)
The MBSheet user interface then opens:

![Graphical User Interface of MBSheet](image.png)

Figure 25: Graphical User Interface of MBSheet

While MBSheet is open, the WAGO-I/O-CHECK user interface is locked.
7.2.2.3 Open MBCONF

For using MBCONF, M-Bus Connector and MBSheet are required to be installed.

Proceed as follows in order to access MBCONF:

1. Open MBSheet (see section “Start-Up” > … > “Open MBSheet”).
2. Open MBCONF.

7.2.2.4 Use MBSheet and MBCONF

Note

Download manuals for MBSheet and MBCONF
You can find information on using MBSheet and MBCONF in the corresponding user documentation, which you can get from the Relay website at:

www.relay.de
7.2.2.5 Exit MBSheet and MBCONF

In order to exit MBSheet or MBCONF, click the “Exit” button in the user interface on the bottom right.

Closing MBSheet also reenables the virtual COM port, so access to the WAGO-I/O-CHECK user interface is possible again. If the lock persists, the virtual COM Port of MBCONF or another recently used application is being used. The notification window informs you which application this is.

In order to remove the lock, proceed as follows:
1. Switch to the application indicated and close it.
2. Close the notification window.

The virtual COM Port is then deleted from the system configuration, and the WAGO-I/O-CHECK user interface can be used again.

7.2.3 Configuration and Access via e!COCKPIT

e!COCKPIT (Item No.: 2759-101/-1101) is an integrated development environment for complex automation tasks and contains all the necessary M-Bus function block libraries. It is installed automatically during the installation of e!COCKPIT.

**Note**

Download e!COCKPIT manual
You can find information on using the e!COCKPIT development environment (Item No.: 2759-101/-1101) in the “e!COCKPIT” software manual, which you can download free of charge from the WAGO website at:

[www.wago.com](http://www.wago.com)
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