M-Bus Master Module, 753-649
Connecting M-Bus Meters

Version 1.0.3
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Number Notation

Table 1: Number Notation

<table>
<thead>
<tr>
<th>Number System</th>
<th>Example</th>
<th>Comment</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 single quotes,</td>
</tr>
<tr>
<td></td>
<td>'0110.0100'</td>
<td>nibble separated by a period</td>
</tr>
</tbody>
</table>

Font Conventions

Table 2: Font Conventions

<table>
<thead>
<tr>
<th>Font Type</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>italic</em></td>
<td>Names of paths and files are shown in italics, e.g.:</td>
</tr>
<tr>
<td></td>
<td>C:\Programs\WAGO-I/O-CHECK</td>
</tr>
<tr>
<td><strong>Menu</strong></td>
<td>Menu options are shown in bold, e.g.:</td>
</tr>
<tr>
<td>&gt;</td>
<td>A “greater than” symbol between two names denotes the selection of</td>
</tr>
<tr>
<td></td>
<td>a menu option, e.g.:</td>
</tr>
<tr>
<td></td>
<td>File &gt; New</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>Names of input or optional fields are shown in bold, e.g.:</td>
</tr>
<tr>
<td>“Value”</td>
<td>Input or selection values are shown in quotation marks, e.g.:</td>
</tr>
<tr>
<td></td>
<td>Enter the value “4mA” under <strong>Start of measurement range</strong>.</td>
</tr>
<tr>
<td><strong>[Button]</strong></td>
<td>Button labels within the dialogs are bold and enclosed in square</td>
</tr>
<tr>
<td></td>
<td>brackets, e.g.:</td>
</tr>
<tr>
<td></td>
<td>[Input]</td>
</tr>
<tr>
<td><strong>[Key]</strong></td>
<td>Key labels on the keyboard are shown in bold and enclosed in square</td>
</tr>
<tr>
<td></td>
<td>brackets, e.g.:</td>
</tr>
<tr>
<td></td>
<td>[F5]</td>
</tr>
</tbody>
</table>
## Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning Icon]</td>
<td><strong>Warning against personal injury!</strong> Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>![Warning Icon]</td>
<td><strong>Do not work on components while energized!</strong> Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>![Warning Icon]</td>
<td><strong>Warning against personal injury!</strong> Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>![Caution Icon]</td>
<td><strong>Warning against personal injury!</strong> Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.</td>
</tr>
<tr>
<td>![Attention Icon]</td>
<td><strong>Warning against damage to property!</strong> Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.</td>
</tr>
<tr>
<td>![ESD Icon]</td>
<td><strong>Warning against damage to property caused by electrostatic discharge!</strong> Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.</td>
</tr>
<tr>
<td>![Note Icon]</td>
<td><strong>Important note!</strong> Indicates a potential malfunction, but one which will not result in damage to property if not avoided.</td>
</tr>
<tr>
<td>![Information Icon]</td>
<td><strong>Additional information</strong> Refers to additional information which is not an integral part of this documentation (e.g., the Internet).</td>
</tr>
</tbody>
</table>
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1 Description

This application note describes how connecting energy meters via an M-Bus interface to the WAGO-I/O-SYSTEM 750 can be implemented. In addition, the application note describes the functional principles of the included sample projects that can be used to read M-Bus meters. The application note also explains how individual elements of the second sample project can be exported and imported into a new project.

Section 5 also describes how the MBSheet readout software from Relay connected to the WAGO-I/O-CHECK commissioning tool. Among other things, MBSheet can be used to read meters that are connected to the M-Bus Master (753-649) without running an IEC application.

2 Material Used

2.1 Required Libraries

<table>
<thead>
<tr>
<th>Library</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WagoAppM_Bus</td>
<td>Library for communicating via the M-Bus protocol</td>
</tr>
<tr>
<td>WagoAppPlcModbus</td>
<td>Library for MODBUS communication</td>
</tr>
<tr>
<td>WagoSysFileDir</td>
<td>Library for file management</td>
</tr>
</tbody>
</table>

2.2 Devices

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Quantity</th>
<th>Designation</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAGO</td>
<td>1</td>
<td>PFC Controller</td>
<td>750-810x</td>
</tr>
<tr>
<td>WAGO</td>
<td>1</td>
<td>4-channel digital output; 24 VDC; 0.5 A</td>
<td>750-504</td>
</tr>
<tr>
<td>WAGO</td>
<td>1</td>
<td>M-Bus Master</td>
<td>753-649</td>
</tr>
<tr>
<td>WAGO</td>
<td>1</td>
<td>End Module</td>
<td>750-600</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>Any M-Bus meter</td>
<td>-</td>
</tr>
</tbody>
</table>
2.3 Tools

<table>
<thead>
<tr>
<th>Designation</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>e!COCKPIT workstation license</td>
<td>2759-101/1110-2002</td>
</tr>
<tr>
<td>WAGO-I/O-CHECK (optional)</td>
<td>759-920</td>
</tr>
</tbody>
</table>

3 Setup

![Connection Diagram]

Figure 1: Connection Diagram

**Note**

**Node configuration!**

The node configuration described is only one example. The setup can be expanded as required by the respective application. The required 24 V supply for the controller is not shown.
Sample Projects

Installation of Sample Projects for e!COCKPIT

Two sample programs are available. The first project “WagoApp_x.x.x.x_M_Bus_Example_01.ecp” is useful for understanding the programming and is intended to illustrate how modules are connected.

The second program “WagoApp_x.x.x.x_M_Bus_Example_02.ecp” is an application to cyclically read multiple M-Bus meters.

4.1 WagoApp_x.x.x.x_M_Bus_Example_01.ecp

4.1.1 Tasks

Two electricity meters with the M-Bus interface are to be read with the help of the WAGO-I/O- SYSTEM. The meters are connected to the WAGO-I/O-SYSTEM via the M-Bus master module (see Figure 1). Application programming is described briefly below.
4.1.2 Application Structure

Figure 3: Source Code of the Sample Program “WagoApp_x.x.x.x_M_Bus_Example_01.ecp”
**4.1.3 Program Description**

Figure 3 shows the basic structure for programming an M-Bus application. A prerequisite for communicating with the M-Bus meter is an M-Bus master module (753-649) and the **FbMBusMaster** function block. The parameters are applied to this module to select the M-Bus master module inserted on the node ("bPortMpBus") and the input signal to reinitialize the master module ("xReset"). The designation of the M-Bus module assigned under the device structure must also be indicated at the “I_Port” input (see Fig. 3).

The **FbMBusElectricity** module is used to read out and decode the data from an M-Bus electricity meter. It can only be used in conjunction with the **FbMBusMaster** module. Synchronization of the two modules is achieved via the "bPortMpBus" input parameter. All other meter modules that are connected to the same M-Bus master module must have the same value applied to them there.

The “xSND_NKE” input should be set if a so-called normalization command is to be sent before the query. This command ensures that, in the case of meters with sequential telegrams, the first (most important) telegram is sent as a reply to the next query. The reading process can be started by setting the “xStart” input or the “xStart_1” variable to the value “TRUE.”

The **FbUnitConverter** function has been added to convert the meter readings from the “typMBus_Record” data type to a required unit and into a REAL type data value. In this way, the meter reading can be made available in REAL data format via a higher-level system (e.g. visualization system). The “eUnit” input determines the units of the output value. The units are abbreviated as follows, e.g.:

- “Mbus_kWh” = kilowatt hours
- “Mbus_Wh” = watt hours
- “Mbus_miWh” = milliwatt hours
Overview of the units

A tabular overview of the supported units can be found in the documentation of the WagoAppM_Bus library. The documentation can be viewed from the library manager or via the [F1] help function.

Rounding errors

Rounding errors in the converted meter readings can occur when using REAL data types. Conversion errors occur with meter readings of 10 digits (6-digit negative) and above.

A timer has been integrated in network 2 of the program code to read the two M-Bus meters. The timer ensures that both “xStart_1” and “xStart_2” variables are reset after the meter reading process is done.

Figure 4 shows the program in online mode. The read and decoded data can be read off under the respective output variables. The output variables of the FbMBusElectricity module have a structure in which the individual elements (e.g. meter reading, power of two, unit) are contained.

Figure 5: Values of the Variables in Online Mode
4.2   WagoApp_x.x.x_x_M_Bus_Example_02.ecp

4.2.1   Tasks

Multiple M-Bus meters of the “Heat meter,” “Electricity meter” and/or “Water meter” type are to be read via the M-Bus master module and the WAGO-I/O-SYSTEM.

The number of meters to be read should be adjustable using a global constant. For each meter, addressing and further definition of the communication parameters and setting the required output units should be made configurable and storable via the visualization. The values read should also be made available via Modbus TCP. The hardware is wired according to the Connection Diagram in Figure 1.

---

**Note**  
Readout order  
Because not all meters can be read simultaneously, the following order is maintained in this example:
1.) Heat meter  
2.) Electricity meter  
3.) Water meter  
Meters with address “0” are skipped automatically.

---

4.2.2   Application Preparation

To use the program, some settings are required that are described below.

1. Open the WagoApp_x.x.x_x_M_Bus_Example_02.ecp project.

2. If necessary, set the communication parameters of the MBusMaster program.

```plaintext
1 PROGRAM MBusMaster
2 VAR
3   _ofMBusMaster : WagoAppM_Bus.FhMBusMaster;
4       xResetMaster : BOOL;
5       sStatusMaster : STRING;
6 END_VAR
```

![Figure 6: Master Module – MBusMaster (PRG)](image)

3. Modules for the Modbus TCP functionality are also available in the MBusMaster program. The TCP server port is initially set to 503 and can be adjusted here. If you do not want MODBUS functionality, you can disable the server by entering “FALSE” at the “xOpen” input.
The upstream modules are used to select the transmission data and should not be changed.

Figure 7: MODBUS Modules – MBusMaster(PRG)

4. In the GVL_M_BUS global variable list, the constants are adjusted that define how many meters are to be read.

```
VAR_GLOBAL CONSTANT
("The minimum number of meters must be "1" ")

bMaxNumberOfMeterHeat : BYTE := 20;
bMaxNumberOfMeterElectricity: BYTE := 20;
bMaxNumberOfMeterWater : BYTE := 20;

END_VAR
```

Figure 8: Global Variable List – Meter Constants

**Important note!**
Note that the constants must be greater than “0” because the internal arrays are initialized with these constants. If you want to exclude a meter type, delete the program call in the main program.
5. If the meter values are to be made available via MODBUS, MODBUS flag words must be defined. Dimensioning is also performed in the \texttt{GVL\_M\_BUS} global variable list and depends on the number of the meters set.

When dimensioning, \textbf{16 flag words} per \textbf{heat meter} and \textbf{6 flag words each} per \textbf{electricity and water meter} must be taken into account. Due to the “DWORD Alignment,” only even numbers can be used as the beginning address. This is rounded up if necessary.

You can use the following formula to calculate the start address of a flag word range, illustrated here for the electrical meters:

\[
\text{StartAddress\_Electro} = \text{StartAddress\_Heat} + (\text{Number\_Meters\_Heat} \times 16)
\]

Example of 20 heat meters (start address = \%MW0):

\[
\text{StartAddress\_Electro} = \text{MW0} + (20 \times 16)
\]

\[
\text{StartAddress\_Electro} = \text{MW320}
\]

\textbf{Note}

\textbf{Important note!}

MODBUS addresses must then be assigned to the flag words. Address assignment is described in item 5 below and must be observed when adjusting the flag word ranges.

\textbf{Note}

\textbf{Adjusting flag words and MODBUS addresses!}

In this application note, the flag word and MODBUS address ranges are adjusted to 20 meters per meter type.

If fewer than 20 meters per type are used, no adjustment should be made to the flag words and MODBUS addresses.

If more than 20 meters of one or more meter types are used, the flag words and MODBUS addresses must be adjusted (see item 4 and 5).
6. **MODBUS addresses** that can be defined in a range from 0 to 65535 must then be assigned to the defined flag words. The addresses spaces are set and assigned in the `GVL_M_BUS` global variable list per meter type via array bounds.

```plaintext
(*Modbus Address-Array*)
awModbusHeatAddresses : AT#MWO : ARRAY [12288..12607] OF WORD;
awModbusElecticityValues : AT#MW320 : ARRAY [12608..12727] OF WORD;
awModbusWaterValues : AT#MW410 : ARRAY [12728..12847] OF WORD;
```

Figure 10: MODBUS Address Range, Heat Meters

When assigning addresses, make sure that the MODBUS address range of a meter type is greater or equal to the size of the associated flag word range.

The minimum number of **MODBUS addresses** required per meter type corresponds to the size of the flag word range defined for this meter type (e.g., 120 flag words for electricity meters → 120 **MODBUS addresses** for electricity meters).

The following form can be used to calculate the required number of meters:

\[
\text{Number\_MODBUSAddresses} = \text{Number\_Meters} \times \text{FlagWords\_per\_Meter}
\]

**Example of 20 electricity meters:**

Number\_MODBUSAddresses\_Electro = 20 meters * 6 flag words per meter

Number\_MODBUSAddresses\_Electro = 120

Figure 11: MODBUS Address Range, Electricity Meters

---

**Important note!**

The MODBUS address ranges of different meter types must be uniquely assigned and may not overlap at any time.
7. The IP address of the controller then has to be set in the **Device Structure**.

![Controller IP Configuration – Device Structure](image1.png)

**Figure 12:** Controller IP Configuration – Device Structure

8. Click **Program > Connect** to load the project into the controller. You can then start the project.

![Loading and Starting the Program – Program Structure](image2.png)

**Figure 13:** Loading and Starting the Program – Program Structure
4.3 Visualization

The visualization is available as a Web visualization. To call up the visualization, enter the following URL in an Internet browser:

http://[IP of the Controller]/webvisu/webvisu.htm

The start page set in the Visualization Manager opens. In the example project, this is the heat meter page. However, you can select any start page in the Visualization Manager, as needed.

Regardless of the set start page, each visualization page in this application note has a central control bar at the top that can be used to navigate to the different meter types.

If you do not need a meter type and thus remove the program call from your main program, the corresponding button in the control bar is also disabled.
4.3.1 Heat Meter (VisuHeatMeter)

The meter data is configured on the **Heat Meter** page.

![Heat Meter Visualization Page](image)

**1 M-Bus meters**

Central operating area to switch between the different meter pages.

- **Heat**: Opens the Heat Meter page.
- **Electricity**: Opens the Electricity Meter page.
- **Water**: Opens the Water Meter page.

**2 Configuration**

In this area, you can click one of the two buttons to save the configurations for all meters to an export file or restore an export file.

Please refer to Section 4.4.

- **Export**: You can save the configuration for all meters to an export file.
- **Import**: You can import the configuration file exported previously. The current configuration is overwritten.
3 Feedback

This area displays various status information.

- **Configured meters**: Displays how many meters have been configured in the global variables.
- **Valid records**: Number of successful meter hits.
- **Invalid records**: Number of failed meter hits.

4 Table control

The current page number is displayed in the control element. The number of pages is automatically adjusted depending on the number of meters configured in the global variables. Up to 10 meters can be displayed per page. If there are fewer than 10 meters, 10 rows are still shown, but the [Show] button to display measured values is hidden. The right and left arrows next to the number of pages are used to switch between pages.

5 Configuration Table

You can adjust the following parameters of the individual meters in the table.

- **Name**: In this column, you can enter the names of the meters. (max. 20 characters)
- **Address**: In this column, you can enter the meter addresses. Secondary (8-digit) and primary (1- to 3-digit) addresses are possible.
- **Send NKE**: In this column, you can define whether a normalization command is sent before the query.
- **Min. send time**: In this column, the minimum interval between successive queries is configured in seconds for each meter. This function is of interest for meters that can only be queried within a certain interval (e.g. battery-operated meters). If “0 s” is set here, the meter is queried cyclically without adherence to a minimum pause.
- **Units**: The units of the measured values are displayed in the columns. If a different unit prefix is required, it can be changed here, and the measured value is converted automatically during the next reading process.
Values: In this column, a [Show] button is available for each meter. Clicking the button displays an overview of the current readings of the respective meter (see 4.3.2).

4.3.2 Heat Meter Values (DialogHeatMeter)

To display the meter values, click the [Show] button as described previously. The following dialog opens:

<table>
<thead>
<tr>
<th>Name:</th>
<th>Address:</th>
<th>1 Name</th>
<th>The configured name of the meter is displayed.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 Address</td>
<td>The configured address of the meter is displayed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Meter values</td>
<td>The meter values are displayed in the configured units.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 [Close]</td>
<td>Click this button to close the dialog.</td>
</tr>
</tbody>
</table>

Figure 17: Heat Meter Values Dialog

- Consumed energy: 0.0 kWh
- Current heat capacity: 0.0 kW
- Water volume: 0.0 m³
- Current flow rate: 0.0 m³/h
- Flow temperature: 21.86 °C
- Return temperature: 21.78 °C
- Difference temperature: 0.08 K
In the event of an error, the meter values are masked by an error message that is displayed in clear text. In a normal state, the error message is not visible.

![Error Message Example](image)

Figure 18: Meter Value Error Message

**Important note!**

Please note that the error indicator, meter values and conversion to the required unit are only updated after reading the meter. Because the meters are read sequentially, it can take some time to display the required values. The time depends on the number of configured meters.
4.3.3 Electricity/Water Meter (VisuElectricityMeter/WaterMeter)

The meter data is configured on the Electricity Meter page. The Water Meter page is identical.

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Send NKE</th>
<th>Min. send time [s]</th>
<th>Units</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>0</td>
<td>kWh</td>
<td>Show</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
<td>kW</td>
<td>Show</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
<td>kWh</td>
<td>Show</td>
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<td>kW</td>
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</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>0</td>
<td>kWh</td>
<td>Show</td>
</tr>
</tbody>
</table>

Figure 19: Electricity/Water Meter Visualization Page

1 M-Bus meters

Central operating area to switch between the different meter pages.

- **Heat**: Opens the Heat Meter page.
- **Electricity**: Opens the Electricity Meter page.
- **Water**: Opens the Water Meter page.

2 Configuration

In this area, you can click the buttons to save the configurations for all meters to an export file or restore an export file. Please refer to Section 4.4.

- **Export**: You can save the configuration for all meters to an export file.
- **Import**: You can import the configuration file exported previously. The current configuration is overwritten.
3 Feedback

This area displays various status information.

- **Configured meters:** Displays how many meters have been configured in the global variables.

- **Valid records:** Number of successful meter hits.

- **Invalid records:** Number of failed meter hits.

4 Table control

The current page number is displayed in the control element. The number of pages is automatically adjusted depending on the number of meters configured in the global variables. Up to 10 meters can be displayed per page. If there are fewer than 10 meters, 10 rows are still shown, but the [Show] button to display measured values is hidden. The right and left arrows next to the number of pages are used to switch between pages.

5 Configuration Table

You can adjust the following parameters of the individual meters in the table.

- **Name:** In this column, you can enter the names of the meters. (max. 20 characters)

- **Address:** In this column, you can enter the meter addresses. Secondary (8-digit) and primary (1- to 3-digit) addresses are possible.

- **Send NKE:** In this column, you can define whether a normalization command is sent before the query.

- **Min. send time:** In this column, the minimum interval between successive queries is configured in seconds for each meter. This function is of interest for meters that can only be queried within a certain interval (e.g. battery-operated meters). If “0 s” is set here, the meter is queried cyclically without adherence to a minimum pause.

- **Units:** The units of the measured values are displayed in the columns. If a different unit prefix is required, it can be changed here, and the measured value is converted automatically during the next reading process.
Values: In this column, a [Show] button is available for each meter. Clicking the button displays an overview of the current readings of the respective meter (see 4.3.4).

4.3.4 Electricity/Water Meter Values (DialogElectricity/WaterMeter)

To display the meter values, click the [Show] button as described previously. The following dialog opens:

```
Name: 
Address: 1
Consumed Energy: 80.0 kWh
Effective electrical power: 0.0281 kW
```

Figure 20: Electricity/Water Meter Values Dialog

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name</td>
</tr>
<tr>
<td>2</td>
<td>Address</td>
</tr>
<tr>
<td>3</td>
<td>Meter values</td>
</tr>
<tr>
<td>4</td>
<td>[Close]</td>
</tr>
</tbody>
</table>

1. Name: The configured name of the meter is displayed.
2. Address: The configured address of the meter is displayed.
3. Meter values: The meter values are displayed in the configured units.
4. [Close]: Click this button to close the dialog.
In the event of an error, the meter values are masked by an error message that is displayed in clear text. In a normal state, the error message is not visible.

Figure 21: Electricity/Water Meter Values Error Message

Important note!
Please note that the error indicator, meter values and conversion to the required unit are only updated after reading the meter. Because the meters are read sequentially, it can take some time to display the required values. The time depends on the number of configured meters.
4.4 Exporting the Configuration Parameters

To prevent data loss when switching the controller, it is possible to export the configuration parameters to a file. The data entered such as “Name”, “Address” or configured units is then saved for future import.

**Important note!**

Please note that only the configuration parameters on the overview page of the respective meter type are saved. The current meter values have to be read again when importing.

If you have entered all configuration parameters in the table successfully, just click the [Export] button. A file is then saved to the \home\codesys_root\ directory on the controller. Using an FTP application, you can then access the controller and copy the file from the specific directory to save it anywhere.

4.5 Importing the Configuration Parameters

You can also import a backup file that you have saved previously. The following factors must be considered:

- The file must accurately reflect the name that was assigned when exporting. “Data_[meter type]” (Heat, Electricity, Water).

- The file must be saved in the \home\codesys_root\ directory on the controller before import.

Click the [Import] button. The file previously saved in the file system is read in and added to the table in the visualization.
4.6 Exporting the Programs

To integrate the readout programs in another project, it is necessary to export certain parts of the project and to import them into the target project. The “Heat Meter” example below describes how parts of the project are necessary for export.

Click File > Import/Export > Program Items > Export.

![Image of Import/Export Menu Item – Export Selection](image)

Figure 22: Import/Export Menu Item – Export Selection
The following window opens:

![Export Items Selection Dialog](image)

**Figure 23: Export Items Selection Dialog**

To export the heat meter functionality, the following parts of the project must be selected:

- **Datatypes > Heat (folder)** → Contains program type variables
- **MBus_Visualization > HeatMeter (folder)** → Heat meter visualization page
- **GVL_M_BUS** (global variable list) → Contains important program parameters
- **Library Manager** → Contains all required libraries
- **GetHeatValues (PRG)** → Heat meter program code
- **MBusMaster (PRG)** → Program code for the master module and MODBUS functions
- **PersistentVars (persistent variables)** → Contains all persistent variables
Click **File > Import/Export > Program Items > Import** and select the export file created.

Figure 24: Import/Export Menu Item – Import Selection

Click **[Open]** to display the following window:

Figure 25: Import Items Selection Dialog
First, you must select the destination for import files on the right side of the dialog. You can then select the **Select All** item on the right side. Click the **[Insert Items]** button to complete the import.

To also execute the **MBusMaster** and **GetHeatValues** programs in the target project, it is necessary to start them in the main program with a program call.

### 4.7 Meter Values via MODBUS

The meter values are provided for MODBUS communication. The readings are linked to MODBUS addresses (see Section 4.2.2 – Item 5) that can be queried externally. The MODBUS addresses and sizes of the meter values are listed in the following table.

<table>
<thead>
<tr>
<th>Note</th>
<th>Important note!</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The MODBUS addresses refer to the standard configuration of 20 meters per meter type. If the number of meters (as described in Section 4.2.2 – Item 3), changes, the MODBUS addresses and flag words (as described in Section 4.2.2 – Items 4 and 5) must be adjusted and the addresses in the tables below are no longer valid.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
<th>Error code!</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>Error messages that arise may be communicated via MODBUS communication as error codes and not as clear text as in the application. You can view the significance of individual error codes in the library description of WagoAppM_Bus.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Note</th>
<th>MODBUS function code:</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The “FC04 (0x04) Read Input Registers” function code must be used to read MODBUS addresses. Write access is not possible.</td>
</tr>
</tbody>
</table>
### 4.7.1 Heat Meter

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Data Type</th>
<th>MODBUS Address</th>
<th>Size (WORD)</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>ValueEnergy</td>
<td>REAL</td>
<td>12288</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValuePower</td>
<td>REAL</td>
<td>12290</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueVolume</td>
<td>REAL</td>
<td>12292</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFlow</td>
<td>REAL</td>
<td>12294</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFTemp</td>
<td>REAL</td>
<td>12296</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueRTemp</td>
<td>REAL</td>
<td>12298</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueDTemp</td>
<td>REAL</td>
<td>12300</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12302</td>
<td>1</td>
<td>R</td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12303</td>
<td>1</td>
<td>R</td>
</tr>
</tbody>
</table>

**Meter 1**

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Data Type</th>
<th>MODBUS Address</th>
<th>Size (WORD)</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>ValueEnergy</td>
<td>REAL</td>
<td>12304</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValuePower</td>
<td>REAL</td>
<td>12306</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueVolume</td>
<td>REAL</td>
<td>12308</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFlow</td>
<td>REAL</td>
<td>12310</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFTemp</td>
<td>REAL</td>
<td>12312</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueRTemp</td>
<td>REAL</td>
<td>12314</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueDTemp</td>
<td>REAL</td>
<td>12316</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12318</td>
<td>1</td>
<td>R</td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12319</td>
<td>1</td>
<td>R</td>
</tr>
</tbody>
</table>

**16 MW per meter**

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Data Type</th>
<th>MODBUS Address</th>
<th>Size (WORD)</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>ValueEnergy</td>
<td>REAL</td>
<td>12592</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValuePower</td>
<td>REAL</td>
<td>12594</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueVolume</td>
<td>REAL</td>
<td>12596</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFlow</td>
<td>REAL</td>
<td>12598</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueFTemp</td>
<td>REAL</td>
<td>12600</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueRTemp</td>
<td>REAL</td>
<td>12602</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>ValueDTemp</td>
<td>REAL</td>
<td>12604</td>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12606</td>
<td>1</td>
<td>R</td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12607</td>
<td>1</td>
<td>R</td>
</tr>
</tbody>
</table>
## 4.7.2 Electricity Meter

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Data Type</th>
<th>Modbus Address</th>
<th>Size (WORD)</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ValueEnergy</td>
<td>REAL</td>
<td>12608</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>ValuePower</td>
<td>REAL</td>
<td>12610</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12612</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12613</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Meter 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ValueEnergy</td>
<td>REAL</td>
<td>12614</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>ValuePower</td>
<td>REAL</td>
<td>12616</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12618</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12619</td>
<td>1 R</td>
<td></td>
</tr>
</tbody>
</table>

6 MW per meter

| Meter 20         |           |                |             |        |
| ValueEnergy      | REAL      | 12722          | 2 R         |        |
| ValuePower       | REAL      | 12724          | 2 R         |        |
| Error            | WORD      | 12726          | 1 R         |        |
| Dummy (Alignment)| WORD      | 12727          | 1 R         |        |

## 4.7.3 Water Meter

<table>
<thead>
<tr>
<th>Data Point</th>
<th>Data Type</th>
<th>Modbus Address</th>
<th>Size (WORD)</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ValueVolume</td>
<td>REAL</td>
<td>12728</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>ValueFlow</td>
<td>REAL</td>
<td>12730</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12732</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12733</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Meter 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ValueVolume</td>
<td>REAL</td>
<td>12734</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>ValueFlow</td>
<td>REAL</td>
<td>12736</td>
<td>2 R</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>WORD</td>
<td>12738</td>
<td>1 R</td>
<td></td>
</tr>
<tr>
<td>Dummy (Alignment)</td>
<td>WORD</td>
<td>12739</td>
<td>1 R</td>
<td></td>
</tr>
</tbody>
</table>

6 MW per meter

| Meter 20         |           |                |             |        |
| ValueVolume      | REAL      | 12842          | 2 R         |        |
| ValueFlow        | REAL      | 12844          | 2 R         |        |
| Error            | WORD      | 12846          | 1 R         |        |
| Dummy (Alignment)| WORD      | 12847          | 1 R         |        |
5  WAGO M-Bus Connector

5.1  Description

The WAGO M-Bus Connector is a driver for the WAGO-I/O-CHECK commissioning tool. After installing the driver, you can launch the MBSheet readout software from the WAGO-I/O-CHECK directly and read a connected M-Bus network or M-Bus meter.

MBSheet is an M-Bus-specific readout software from Relay. The software provides different functions for reading and testing M-Bus networks. In addition to the meter scan, for example, you have the option of creating meter lists, editing lists, reading meters (cyclic) or addressing or changing M-Bus subscribers.

How to install and launch the driver with the MBSheet software is described below.

---

**Note**

WAGO-I/O-CHECK!
To successfully install the driver, the WAGO-I/O-CHECK commissioning tool must first be installed.

---

5.2  Installation

**Note**

Download WAGO M-Bus Connector Set-up!
The WAGO M-Bus Connector Set-up must be downloaded at [http://www.wago.com](http://www.wago.com) before starting.
The set-up contains both the driver and MBSheet software (demo version) from Relay.

Unpack after downloading the Set-up archive. Make sure that both mbsheet.exe and Wago-MBusConnector-Setup(x.x.).exe application files are stored in an identical path (e.g., in a folder).

Launch the installation by double-clicking the file Wago-MBusConnector-Setup.exe.
After selecting the installation language, follow the instructions of the installation wizard to install the driver. After installing the WAGO M-Bus Connector successfully, the following window appears:

![WAGO M-Bus Connector Installation](image)

If automatic installation start is not selected, the installation must be performed at a later time. To do so, execute the `mbsheet.exe` installation file.

After the MBSheet installation wizard is open, select the installation language and follow the installation instructions. After completing the installation, the readout software can be launched and used from WAGO-I/O-CHECK. The exact process is described in the next section.
5.3 Launching the MBSheet Software

This section describes how to launch and use the installed MBSheet software from WAGO-I/O-CHECK.

1. Launch WAGO-I/O-CHECK.
2. Open the “Communication Settings” window in Settings > Communication or by pressing [F8] and enter the IP address of your controller.

![Communication Settings](image1)

Figure 28: WAGO-I/O-CHECK Communication Settings

3. Apply the settings and read the current node configuration by pressing the [Identify] button. The node configuration of the addressed controller should then be visually displayed.

![Node Identification](image2)

Figure 29: WAGO-I/O-CHECK Node Identification
4. Select the M-Bus Master (753-649).
   You can now press the [Settings] button to open MBSheet. You can also
   launch the software by right-clicking on the M-Bus Master and selecting the
   Settings menu item.

![Figure 30: WAGO-I/O-CHECK Read Nodes](image_url)

5. After opening MBSheet, the software can then be used to read, test or address
   M-Bus meters.

**Note**

**MBSheet software functions!**

The structure and functional scope of the readout software are roughly explained below. Please contact the manufacturer directly for a detailed description of all functions.

You can set connection parameters (COM port and baud rate) at the top right of
the software. Below that are buttons, for example, to start a meter scan or to read
meters that have already been found. The resulting meter list is displayed in the
top table and read meter data is listed in the bottom table. Right-click on a meter
to open a submenu with additional functions.

Because this installation is a demo version of MBSheet, there is no option to
directly print or save the meter list or meter data as a CSV file from the
application.
Figure 31: MBSheet Software Setup