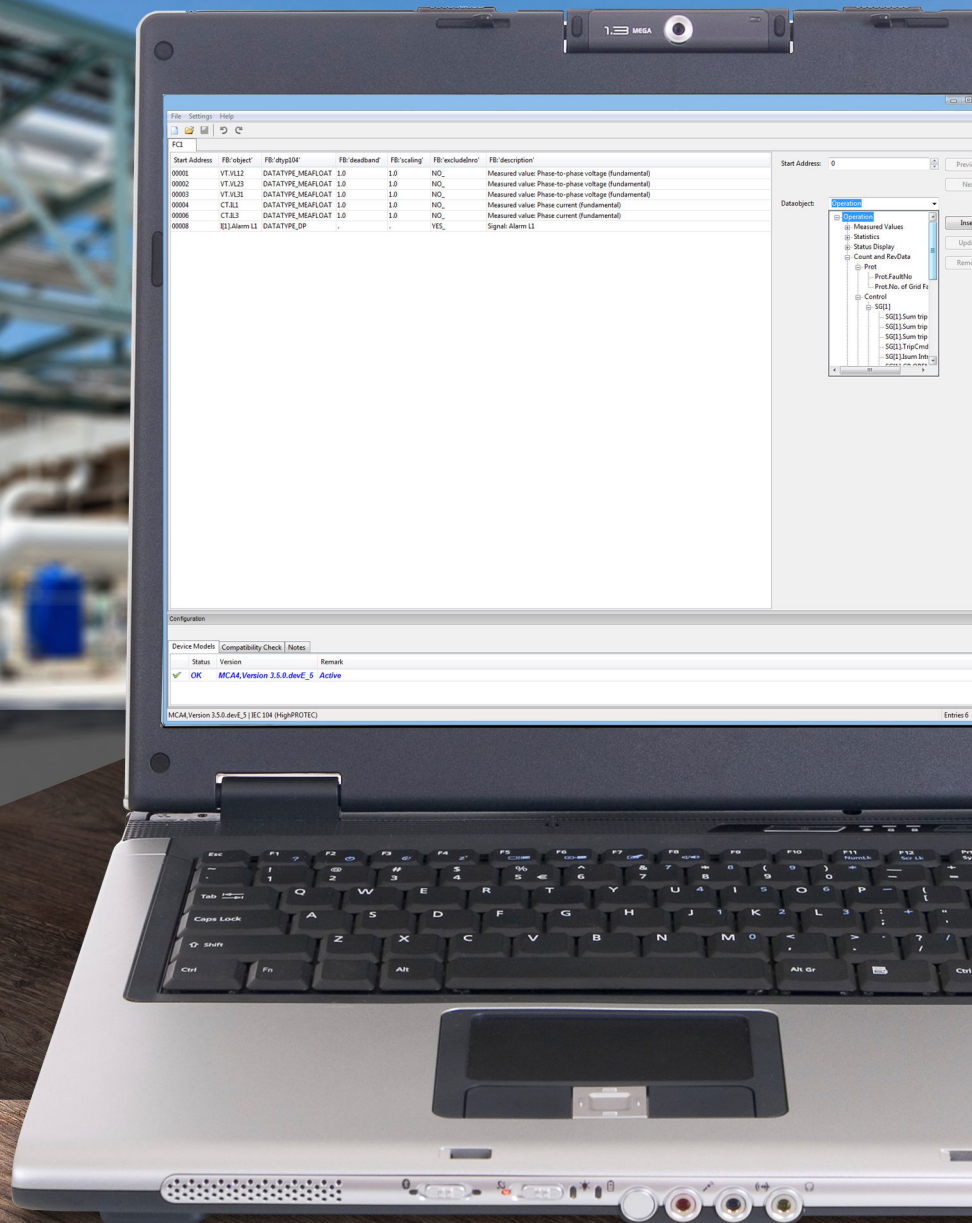


SCADAPTER

SCADA Protocol Configuration Tool

Manual SCADAP-1.0-EN-MAN



SCADAPTER

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Woodward Kempen GmbH

Krefelder Weg 47 • D-47906 Kempen (Germany)

Postfach 10 07 55 (P.O.Box) • D-47884 Kempen (Germany)

Telephone: +49 (0) 21 52 145 1

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1 Important Definitions

The types of messages shown below serve the safety of life and limb as well as for the appropriate operating life of the device.

DANGER!



DANGER indicates an immediately dangerous situation that will result in death or serious injury if it is not avoided.

WARNING!



WARNING indicates a hazardous situation that can result in death or serious injury if it is not avoided.

CAUTION!



CAUTION indicates a possibly hazardous situation that can result in minor or moderate injuries if it is not avoided.

NOTICE!



NOTICE is used to address practices not related to personal injury.



This symbol indicates useful tips and recommendations as well as information for efficient and trouble-free operation.

Proper Use of the Device and of This Manual

WARNING!



FOLLOW INSTRUCTIONS

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

WARNING!**PROPER USE**

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (1) constitute “misuse” and/or “negligence” within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (2) invalidate product certifications or listings.

The programmable devices subject to this manual are designed for protection and also control of power installations and operational devices that are fed by voltage sources with a fixed frequency, i.e. fixed at 50 or 60 Hertz. They are not intended for use with Variable Frequency Drives. The devices are further designed for installation in low-voltage (LV) compartments of medium voltage (MV) switchgear panels or in de-centralized protection panels. The programming and parameterization has to meet all requirements of the protection concept (of the equipment that is to be protected). You must ensure that the device will properly recognize and manage (e. g. switch off the circuit breaker) on the basis of your programming and parameterization all operational conditions (failures). The proper use requires a backup protection by an additional protective device. Before starting any operation and after any modification of the programming (parameterization) test make a documentary proof that your programming and parameterization meets the requirements of your protection concept.

The Self-Supervision Contact (Life-Contact) has to be wired with the substation automation system in order to supervise and monitor the state of health of the programmable protective device. It is very important that an alarm annunciation is driven from the programmable protective device self-supervision contact (Life-Contact) that requires immediate attention when tripped. The alarm indicates that the protective device is no longer protecting the circuit and the system should be serviced.

Typical applications for this product family/device line are for instance:

- Feeder protection
- Mains protection
- Machine protection
- Transformer Protection
- Generator Protection

Any usage beyond these applications the devices are not designed for. This applies also to the use as a partly completed machinery. The manufacturer cannot be held liable for any resulting damage, the user alone bears the risk for this. As to the appropriate use of the device: The technical data and tolerances specified by *Woodward* have to be met.



Out-of-date documentation?

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, please visit the download section of our website.

Please check the web site of Woodward for the latest revision of this Technical Manual and if there is an Errata Sheet with updated information.

- Visit the company website (\Rightarrow www.woodward.com) and search for the documents you are interested in. (The ID of every document is printed on its cover page.)
- Alternatively, every HighPROTEC device has a QR code printed on it. Scan this code, and you are taken to an online directory that contains all relevant documents in the most recent version.

Important Information

WARNING!



In line with the customer's requirement the devices are combined in a modular way (in compliance with the order code). The terminal assignment of the device can be found on the top of the device (wiring diagram).

CAUTION!**Electrostatic Discharge Awareness**

All electronic equipment is electro static-sensitive, some components more than others. To protect these components from electro static damage, you must take special precautions to minimize or eliminate electrostatic discharges. Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).
2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.
4. Do not remove any printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
 - Verify the safe isolation from supply. All connectors have to be unplugged.
 - Do not touch any part of the PCB except the edges.
 - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
 - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

To prevent damage to electronic components caused by improper handling, read and observe the precautions in the *Woodward* manual 82715, "Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules".

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2 Application Overview

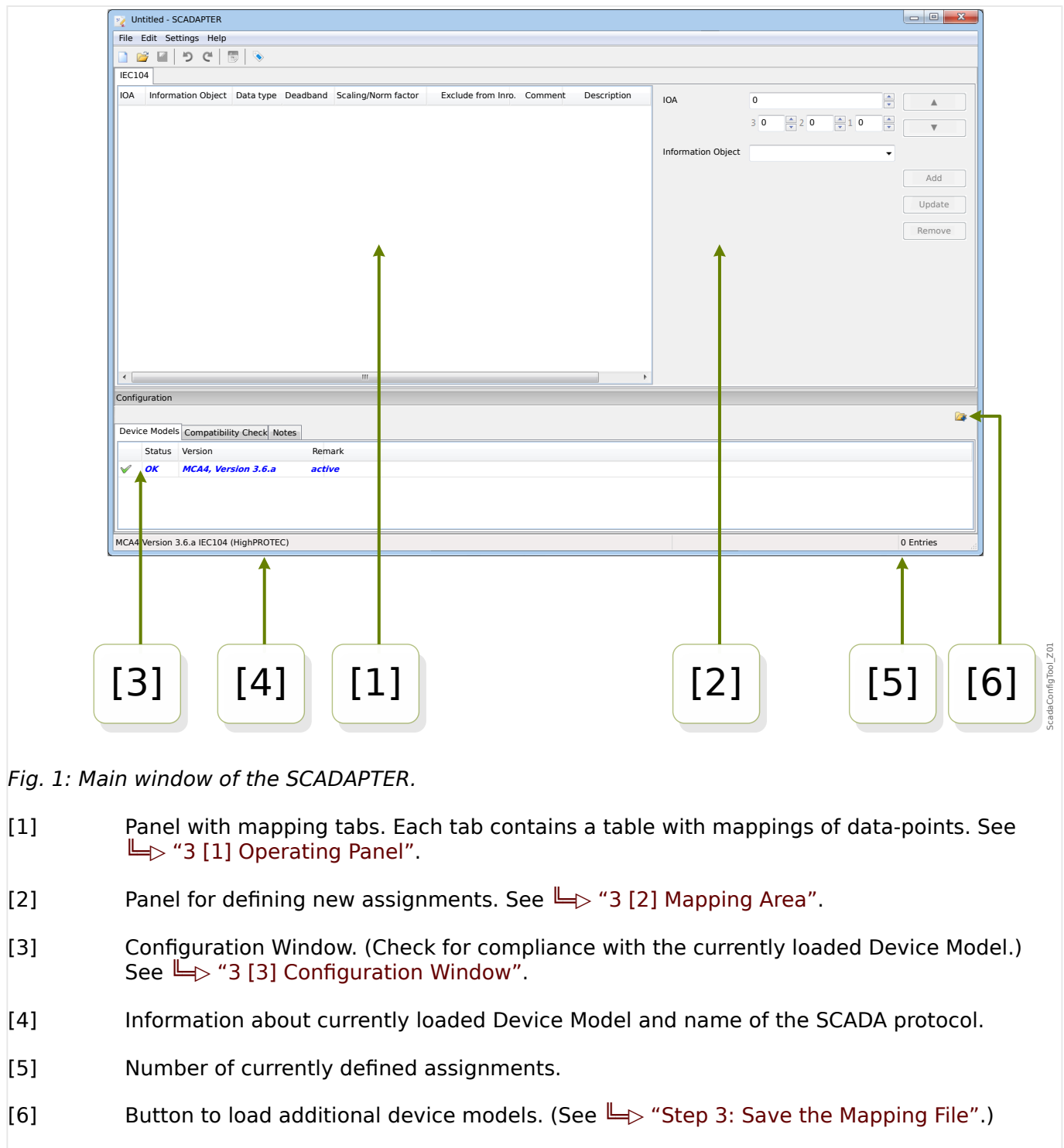


Fig. 1: Main window of the SCADAPTER.

- [1] Panel with mapping tabs. Each tab contains a table with mappings of data-points. See [↳ “3 \[1\] Operating Panel”](#).
- [2] Panel for defining new assignments. See [↳ “3 \[2\] Mapping Area”](#).
- [3] Configuration Window. (Check for compliance with the currently loaded Device Model.) See [↳ “3 \[3\] Configuration Window”](#).
- [4] Information about currently loaded Device Model and name of the SCADA protocol.
- [5] Number of currently defined assignments.
- [6] Button to load additional device models. (See [↳ “Step 3: Save the Mapping File”](#).)

The SCADAPTER is a graphical SCADA Protocol Mapping Tool. It allows for defining a mapping from the measured values and logical states of a protection device to the protocol-specific object data. This way the protection device can be made fully compatible with some previously used protection device, so that there is no need to make any changes to the existing SCADA communication.

These defined mappings are saved in a special SCADA configuration file with the filename extension *.HptSMap. Finally the *.HptSMap can be accessed after having established an connection between *Smart view* and the protection device, so that *Smart view* can transfer the mappings and make them effective within the protection device.

It is possible to launch the *SCADAPTER* the usual way, (for example) via the Windows Start button. But if you have *Smart view* already running it is probably more convenient to use the menu item [*Tools* → *SCADAPTER*].

Currently the *SCADAPTER* supports the following protocols and protection devices:

SCADA Protocols:

- Modbus
- IEC 60870-104

Protection Devices:

- All HighPROTEC devices as of Release **3.6**.

Installation of the SCADAPTER

System requirements:

Windows 7, Windows 8.x or Windows 10

The *SCADAPTER* does not need a separate installation process, because it is always installed along with *Smart view*.

Uninstalling SCADAPTER

The *SCADAPTER* does not need a separate uninstall process, because it is always removed together with *Smart view*.

3 Panels of SCADAPTER's Main Window

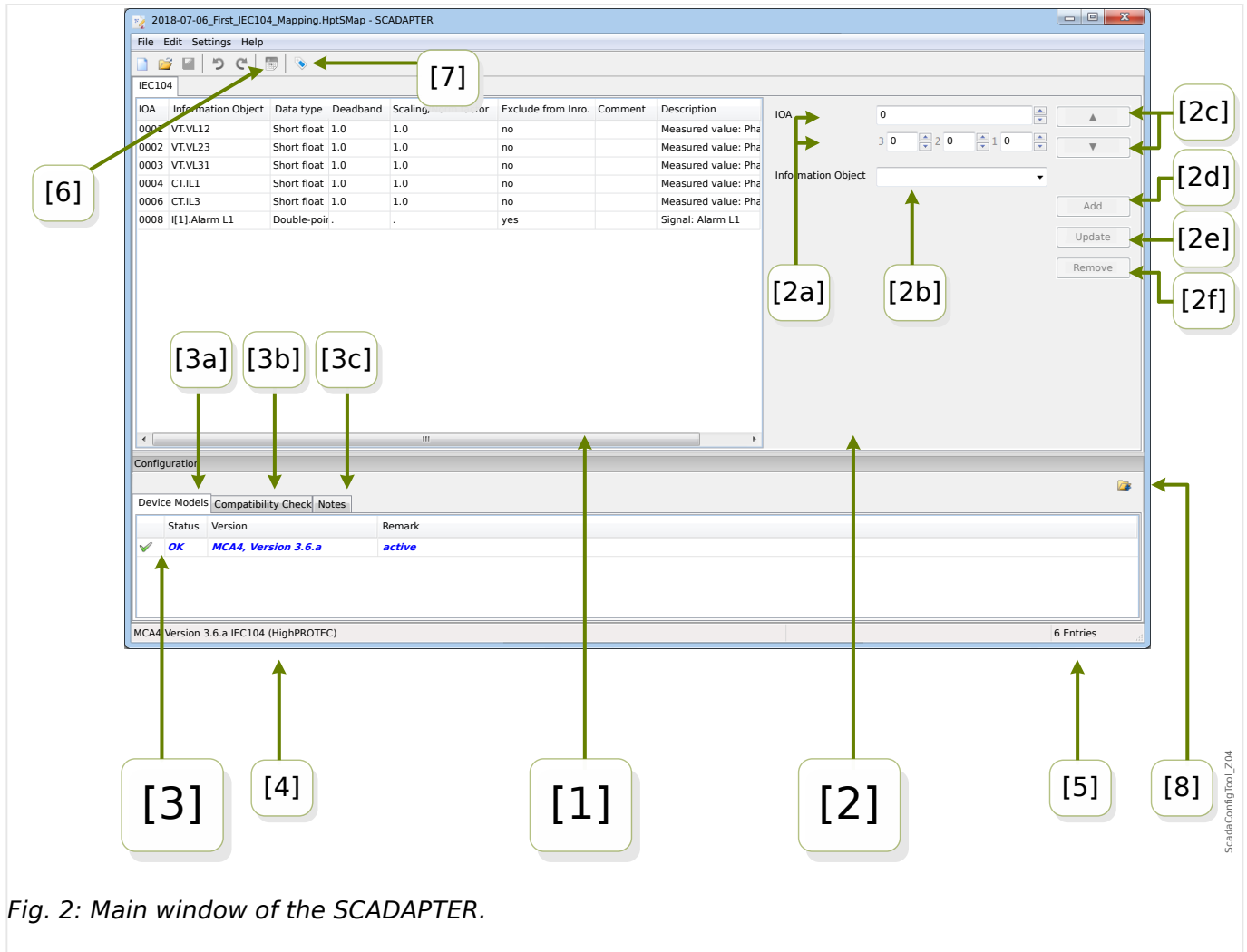


Fig. 2: Main window of the SCADAPTER.

- [1] – Panel with mapping tabs. Each tab lists the Function Block mappings for this Function Code. See [“3 \[1\] Operating Panel”](#).
- [2] – Panel for defining or changing assignments. See [“3 \[2\] Mapping Area”](#).
- [3] – Configuration Window. (Check for compliance with the currently loaded Device Model.) See [“3 \[3\] Configuration Window”](#).
- [3a] – Information about currently loaded Device Model and name of the SCADA protocol. (See [“Step 1: Create a new Mapping or open a previously created *.HptSMap file”](#).)
- [3b] – Tab with a detailed list of compatibility issues. (See [“Step 3: Save the Mapping File”](#).)
- [3c] – Tab with additional notes that can be entered by the user. (See [“Step 3: Save the Mapping File”](#).)
- [4] – Information about currently active Device Model and name of the SCADA protocol.
- [5] – Number of currently defined assignments.

- [6] – Button that allows for saving all mappings to a file in *Microsoft Excel* (*.xlsx) format or as comma-separated values (*.csv).
- [7] – Button that open a dialog where you can enter “Config version” and “Config info”.

These are both text-values that can be set without restrictions. They are stored with the *.HptSMap file, and after transfer to the protection device they are visible within the menu [Device Para / »SCADA-protocol-name« / Config. Data Obj.]. For the SCADA protocol itself, however, they do not have any technical effect.

The function of this button is identical with the menu [Edit / Version Info], see [↪ “4 Edit Menu”](#).

- [8] – Button to load additional device models. (See [↪ “Step 3: Save the Mapping File”](#).)

[1] Operating Panel

The Operating Panel shows all assignments that have already been defined. For each Function Code of the SCADA protocol, there is a specific tab, which lists the mappings for this Function Code in form of a table.

Note that the mapping always depends on a particular device model, because the telegrams of some SCADA protocol may reference only data that are actually supported by the protection device. (You cannot have a mapping for voltage measurement values, for example, if you are configuring a protection device without voltage transformers.) So, after all, it is important to always select a device model first, because all the mappings that are going to be saved in a *.HptSMap file do always reference a particular device model file. (For details see [↪ “Creation of a Protocol Mapping”](#).)

[2] Mapping Area

This is a panel for entering the properties of a new mapping. The actual fields where the properties shall be entered are dependent on the selected SCADA protocol and of the type of device data that shall be mapped. (Some measurement value, for instance, has different properties than a binary state value.)

These fields and elements, however, do always appear:

- [2a] – *Start Address* – Enter the protocol-internal numeric address for which you want to create an assignment. This address is a decimal number.

Only for IEC 60870-5-104: Since this numeric address is the result of the values of three bytes there are also three number fields for the individual byte values. A change of the any of these values automatically updates all affected other fields. (For example, if you enter the number **1** into the “byte 2” field the »IOA« gets increased by **256**.)

- [2b] – *Data Object* – The device-internal data that shall be mapped to the protocol address.

All the available data are defined in the referenced device model and can be accessed if one clicks on the small “▼” triangle at the right right margin of the input field: Then a tree structure unfolds that shows all available data, subordinated in categories such as “Measured Values”, “Statistics”, “Status Display”, etc. From there one can select the data object to be mapped. Depending on the selection some more input fields for the properties of the object might become visible.


- [2c] – Buttons »▲« (Previous), »▼« (Next) – Click these buttons to (re-)select the previous or next row from the table of assignments, respectively.

- [2d] - Button »Add« - Click this button after all properties of an assignment have been specified. This adds the mapping to the table of assignments as a new row. An assignment can be “new” only if the start address has not been mapped yet.
- [2e] - Button »Update« - Click this button after you have selected an existing row from the table of assignments and made some changes to the properties. This modifies the existing table row.
- [2f] - Button »Remove« - Click this button after you have selected an existing row from the table of assignments. This removes the table row.

[3] Configuration Window



This panel comprises the following tabs (sub-elements):

- [3a] - *Device Models* - Overview of all loaded Device Models. Definition of the active Device Model. The active Device Model controls which data objects and value types are available to the user. The status field reports if the created mapping is compatible to the Device Model.
- [3b] - *Compatibility Check* - Compatibility Table between the loaded Device Model and all defined mappings.
- [3c] - *Notes* - User-defined text to describe the purpose of the protocol mappings under construction.

The creation process of a protocol mapping is detailed in  “[Creation of a Protocol Mapping](#)”.

4 SCADAPTER's Main Menu


[File] **Menu**

- [File / New] – This option creates a new mapping file. The user is asked for a device model, then for a SCADA protocol, finally he/she is able to create the assignments. See  “Step 1: Create a new Mapping or open a previously created *.HptSMap file”.
- [File / Open] – This option opens an existing mapping file, so that he/she can check and/or modify the assignments. See  “Step 1: Create a new Mapping or open a previously created *.HptSMap file”.
- [File / Save] – This option saves the assignments that are currently in work to an (existing) mapping file.
- [File / Save As] – This option saves the assignments that are currently in work to a (new) mapping file. The user is asked to specify a filename.
- [File / Recent Files] – This is a list of recently opened mapping files, for quick access.
- [File / Quit] – This option terminates the *SCADAPTER*.

[Edit] **Menu**

- [Edit / Undo] – Undo the last mapping-related editing step.
- [Edit / Redo] – Undo the last Undo step.
- [Edit / Version Info] – Open a dialog where you can enter the “Config version” (version information of the mapping) and the “Config info” (user/author information).


These are both text-values that can be set without restrictions. They are stored with the *.HptSMap file, and after transfer to the protection device they are visible within the menu [Device Para / »SCADA-protocol-name« / Config. Data Obj.]. For the SCADA protocol itself, however, they do not have any technical effect.

This menu item is actually the same as the button “[7]” in the main window  Fig. 2.

[Settings] **Menu**

- [Settings / Application Language] – The language that *SCADAPTER* uses for its graphical user interface can be selected.

A change, however, becomes effective only after a restart of the *SCADAPTER*.

- [Settings / Device Model Language] – Select the language that *SCADAPTER* uses for displaying the data objects that are available with the protection device. See also  “Step 2: Add Assignments and/or Modify the Existing Ones”

This setting is available only after a valid device model or an existing mapping file has been loaded.

A change of the device model language becomes effective only after a restart of the *SCADAPTER*.



The choice of language does not mean any restriction for later use of the SCADA protocol assignments. Every device model of a HighPROTEC device always has all parameters, values and states named in various languages, which are already built in. This means the language can always be changed at any time (to any of the supported languages).

The set of languages supported by a device model can be different from the set of languages that is available for the graphical user interface of the *SCADAPTER*.

[Help] **Menu**

The [Help / Help] menu item launches the *SCADAPTER* online-help.

The [Help / Program Information] menu item launches a window that displays *SCADAPTER*-related version and copyright information.

5 Creation of a Protocol Mapping

Creating a mapping file is a procedure involving the following steps:

- **Step 1:** Create a new Mapping or open a previously created *.HptSMap file.
- For a new file the *SCADAPTER* asks for the Device Model of the target device and for the SCADA protocol.
- **Step 2:** Add assignments and/or modify the existing ones.
- **Step 3:** Save the mapping file.

The transfer of the protocol mappings onto the protection relay is done with *Smart view*:

- **Step 4:** Connect the target device to *Smart view*.
- **Step 5:** Open the »SCADA Point Mapping Configuration« dialog and select the mapping file.


5.1 Step 1: Create a new Mapping or open a previously created *.HptSMap file

Option 1: Start from Scratch – Create a new Mapping

In order to create a new mapping select the menu item [File / New].

- Select a Device Model: The *SCADAPTER* asks you to select the Device Model of your target device. If you do not know the Device Model of your protective relay yet, you can read it out by using the relay's HMI or *Smart view*. There you can find the Device Model [Device Para / Version] »DM-Version«. The selected Device Model provides all the information that the *SCADAPTER* needs to check compatibility of the protocol definition.

Please note that only device models can be loaded that are installed or loaded (from devices) on your computer.

- Next, the *SCADAPTER* asks to specify the SCADA protocol for which the mapping shall be defined. See  [Chapter 2](#) for the supported protocols.

*Option 2: Open/Edit an Existing *.HptSMap Mapping Page*

- Select the menu item [File / Open].
- The *.HptSMap file already contains a reference to a device model and a protocol selection, so that you need to specify these again. But note that in case you have created the *.HptSMap file on some other computer you have to make sure that the device model has been installed or can be loaded from a connected device.

5.2 Step 2: Add Assignments and/or Modify the Existing Ones

FC1 ... FC6 (Modbus) / IEC104:

If you have selected IEC 60870-5-104 as SCADA protocol, there is one tab with a table that holds all mapped data objects.

If you have selected Modbus as SCADA protocol, you can see several tabs labeled “FCx”. Each of these tabs represents a Modbus Function Code and features a table that holds the mapped data objects.

The “Function Code” number decides about the type of data-objects that it can hold:

- FC1, FC2 hold states (but no measurement values).
- FC3, FC4 can hold all types except commands.
- FC5, FC6 are for commands.
- FC16 is for special multi-word messages (essentially for time-synchronization).

Start Address:

On the Mapping Panel (↳ “Panels of SCADAPTER's Main Window”, ↳ “3 [2] Mapping Area”) you have to enter the protocol-internal address first. This is a decimal number, and you can either type it in directly, or use the small “▲” and “▼” buttons to increase or decrease the previously selected address number.

Only for IEC 60870-5-104: Since the address number is the result of the values of three bytes there are also three number fields for the individual byte values. A change of the any of these values automatically updates all affected other fields. (For example, if you enter the number **1** into the “byte 2” field the »IOA« gets increased by **256**.)

Data object:

Expand the selection list and select the data object that you want to assign to the protocol address, e. g. [Operation / Measured Values / Voltage] »VX meas«.

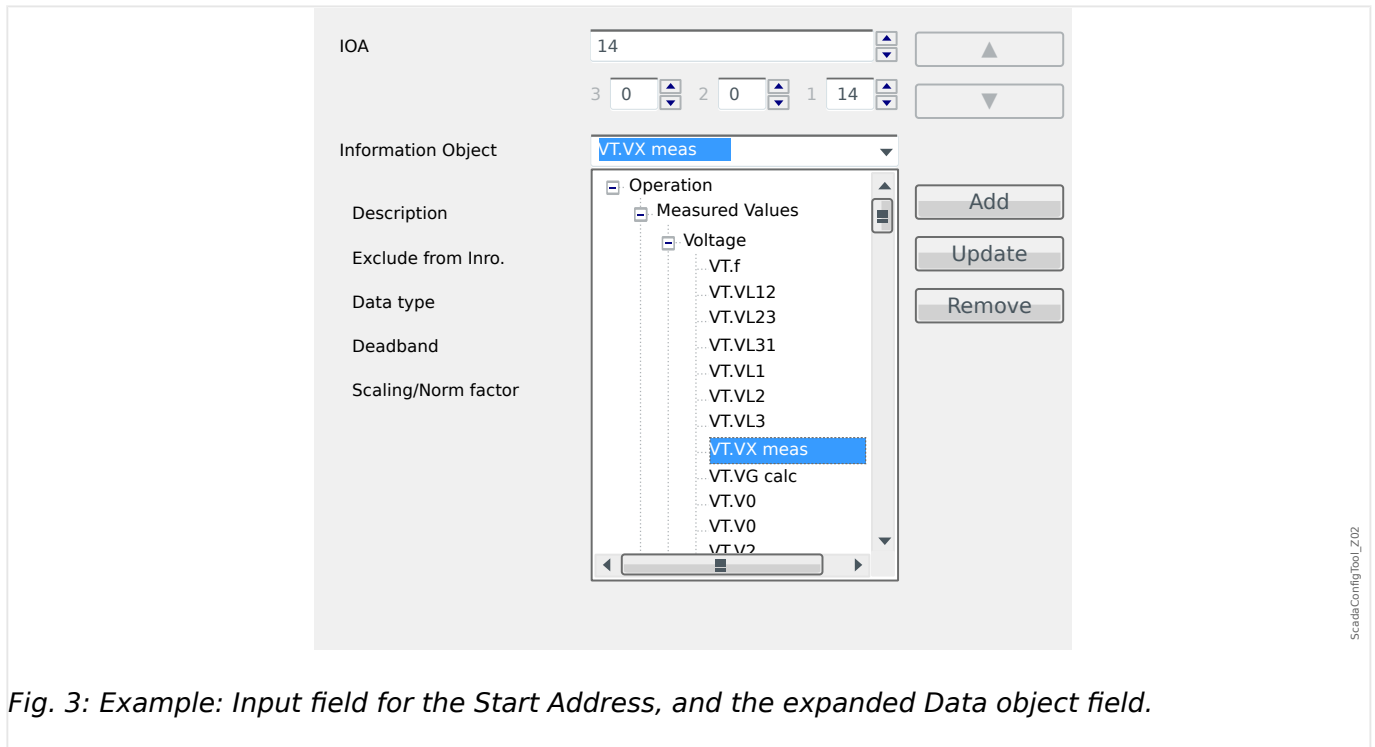


Fig. 3: Example: Input field for the Start Address, and the expanded Data object field.

After the data object has been selected, some more input fields become visible, depending on the type of data object and depending on the selected SCADA protocol (↳ “Modbus Protocol” Modbus or ↳ “IEC 60870-5-104 Protocol” IEC 60870-5-104).

5.2.1 Modbus Protocol

The following additional input fields become visible on the mapping panel (↳ “Step 2: Add Assignments and/or Modify the Existing Ones”) in case of the Modbus protocol:

- *Comment* – User-defined text without any technical functionality. It can be used for archiving some background information of the mapping.
- *Description* – Additional explanatory text for the selected data object (if available in the Data Model).
- *Latched* – The “Latched” checkbox decides whether the Modbus information shall be latched (until an explicit acknowledgment).
- *Format* – Select the format of the data-object:
 - Int16 – Integer number with 16 bit length
 - Uint16 – Unsigned (i.e. non-negative) integer number with 16 bit length
 - Int32 – Integer number with 32 bit length
 - Uint32 – Unsigned (i.e. non-negative) integer number with 32 bit length
 - Float – Number in floating point representation (according to IEEE 754)
- *Bit position* – The bit position appears only where it makes sense to select it (in particular with binary states of 1 bit length).
- *Bit size* – The bit size is automatically set according to the format of the data-object.
- *Factor, Scaling* – For measured values and statistical data, specify the factor and the scaling of the data (if these input fields are visible). The scaling can be as follows:
 - Primary – Scaling of the information object to primary value
 - Secondary – Scaling of the information object to secondary value
 - Relative – Scaling of the information object relative to nominal value
- *Fault value* – If ticked then the fault value is used, instead of the ongoing / actual measured value.

5.2.2 IEC 60870-5-104 Protocol

The following additional input fields become visible on the mapping panel (↳ “Step 2: Add Assignments and/or Modify the Existing Ones”) in case of the IEC 60870-5-104 protocol:

- *Comment* – User-defined text without any technical functionality. It can be used for archiving some background information of the mapping.
- *Description* – Additional explanatory text for the selected data object (if available in the Data Model).
- *Exclude from Inro.* – If ticked then the data object shall not be part of a general interrogation.
- *Data type* – Select the type of data that this data object represents.

The IEC 104 protocol defines the following data types for measured (and statistical) values:

- Normalized — Measured value, normalized value (M_ME_TD_1),
- Scaled — Measured value, scaled value (M_ME_TE_1),
- Short float — Measured value, short floating point number (M_ME_TF_1).

The IEC 104 protocol defines the following data types for binary states:

- Single-point — Single-point information (M_SP_TB_1),
- Double-point — Double-point information (M_DP_TB_1),
- Bitstring — Bitstring of 32 bit (M_B0_TB_1).

The IEC 104 protocol defines the following data types for commands:

- Single-point — Single-point information (C_SC_NA_1),
- Double-point — Double-point information (C_DC_NA_1).
- Deadband – For measured (and statistical) values: Define the value change for this data object (in percent of the maximum value) that will cause the protection device to re-send the changed value. See also the examples given at [↳ “Deadband Settings in IEC 60870-5-104”](#).

Deadband – For counter values (integer numbers): Define the value increment that will cause the protection device to re-send the changed value.

- Scaling/Norm factor – Define the scaling factor for the value of this data object.
- *Fault value* – If ticked then the fault value is used, instead of the ongoing / actual measured value.

5.2.2.1 Deadband Settings in IEC 60870-5-104

The Deadband setting »*Deadband*« specifies for a measured (or statistical) value, for which value change the updated value is transmitted again.

Cyclic transmission is defined for a measured value by setting the Deadband percentage for this measured value to zero.

A non-zero Deadband percentage always refers to the *maximum* value of the respective measured value, see the following examples.

Examples for Deadband Settings

The Deadband setting shall be detailed by some examples.

Voltage (via “TU” Voltage Measuring Card)

- The voltage transformer card “TU” covers the voltage range 0 – 800 V. (See the “Technical Data” chapter in the manual.) In other words, the **maximum** value is **800 V**.
- The **rated** value (secondary) is **100 V**.
- Therefore the conversion factor from the percentage of the rated voltage to the *Deadband setting* is:

$$q = 100 \text{ V} / 800 \text{ V} = \mathbf{0.125}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* voltage, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.0125 = \mathbf{1.25\%}$$

Currents (1 A CT)

- The 1 A current transformers cover the range 0 - 40 A.
- The **rated** current (secondary) is **1 A**.
- Therefore the conversion factor from the percentage of the rated current to the *Deadband setting* is:

$$q = 1 \text{ A} / 40 \text{ A} = \mathbf{0.025}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* current, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.0025 = \mathbf{0.25\%}$$

Currents (5 A CT)

- The 5 A current transformers cover the range 0 - 200 A.
- The **rated** current (secondary) is **5 A**.
- Therefore the conversion factor from the percentage of the rated current to the *Deadband setting* is:

$$q = 5 \text{ A} / 200 \text{ A} = \mathbf{0.025}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* current, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.0025 = \mathbf{0.25\%}$$

Earth (Ground) Current (1 A CT)

- The standard current transformer card "TI" covers the range 0 - 25 A.
- The **rated** current (secondary) is **1 A**.
- Therefore the conversion factor from the percentage of the rated current to the *Deadband setting* is:

$$q = 1 \text{ A} / 25 \text{ A} = \mathbf{0.04}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* current, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.004 = \mathbf{0.4\%}$$

Sensitive Earth (Ground) Current (1 A CT)

- The sensitive current transformer card “TIs” covers the range 0 – 2.5 A.
- The **rated** current (secondary) is **1 A**.
- Therefore the conversion factor from the percentage of the rated current to the *Deadband setting* is:

$$q = 1 \text{ A} / 2.5 \text{ A} = \mathbf{0.4}$$

- For example, a deadband value of **1%**, given as a percentage of the *rated* current, is required.
- Then the Deadband setting value must be as follows:

$$1\% \cdot q = 0.004 = \mathbf{0.4\%}$$

Power (1 A CT and “TU” Voltage Measuring Card)

- The value range is 0 – 32000 VA.
- The **rated** power (secondary) is based on the rated voltage and the rated current (secondary): $100 \text{ V} \cdot 1 \text{ A} \cdot \sqrt{3} = \mathbf{173.21 \text{ VA}}$.
- Therefore the conversion factor from the percentage of the rated power to the *Deadband setting* is:

$$q = 173.21 \text{ VA} / 32000 \text{ VA} = \mathbf{0.00541}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* power, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.000541 = \mathbf{0.0541\%}$$

Power (5 A CT and “TU” Voltage Measuring Card)

- The value range is 0 – 160000 VA.
- The **rated** power (secondary) is based on the rated voltage and the rated current (secondary): $100 \text{ V} \cdot 5 \text{ A} \cdot \sqrt{3} = \mathbf{866.05 \text{ VA}}$.
- Therefore the conversion factor from the percentage of the rated power to the *Deadband setting* is:

$$q = 866.05 \text{ VA} / 160000 \text{ VA} = \mathbf{0.00541}$$

- For example, a deadband value of **10%**, given as a percentage of the *rated* power, is required.
- Then the Deadband setting value must be as follows:

$$10\% \cdot q = 0.000541 = \mathbf{0.0541\%}$$

Frequency (50 Hz Network)

- The value range is 40 – 70 Hz.
- The **rated** frequency is: **50 Hz**.

- Therefore the conversion factor from the percentage of the rated frequency to the *Deadband setting* is:

$$q = 50 \text{ Hz} / 70 \text{ Hz} = \mathbf{0.714}$$

- For example, a deadband value of **0.1%**, given as a percentage of the *rated* frequency, is required.
- Then the Deadband setting value must be as follows:

$$0.1\% \cdot q = 0.000714 = \mathbf{0.0714\%}$$

Frequency (60 Hz Network)

- The value range is 40 – 70 Hz (i. e. the same as for 50 Hz).
- The **rated** frequency is: **60 Hz**.
- Therefore the conversion factor from the percentage of the rated frequency to the *Deadband setting* is:

$$q = 60 \text{ Hz} / 70 \text{ Hz} = \mathbf{0.857}$$

- For example, a deadband value of **0.1%**, given as a percentage of the *rated* frequency, is required.
- Then the Deadband setting value must be as follows:

$$0.1\% \cdot q = 0.000857 = \mathbf{0.0857\%}$$

$\cos(\varphi)$

This value is special because there is no rated value.

- The maximum value is 1.0.
- For example, a deadband value of **0.01** is required. (It makes not much sense to talk of percentages here.)
- Then the Deadband setting value must be as follows:

$$0.01 / 1.0 = \mathbf{1\%}$$

φ

- All angle values are given in degree units, i. e. the maximum value is 360°.
- For example, a deadband value of **1°** is required. (It makes no sense to talk of percentages here.)
- Then the Deadband setting value must be as follows:

$$1^\circ / 360^\circ = \mathbf{0.278\%}$$

5.3 Step 3: Save the Mapping File


Compatibility Check

Before you can transfer the Protocol Definition into the target device, you have to check whether it is compatible with your protection relay. The compatibility check of your created mapping file with the target device is done by means of the device model that has been loaded at the beginning.

NOTICE!



It is possible to load additional device models, so that the compatibility check is performed for all of them in one go.

Click the button with the folder symbol and the plus sign (“[6]” in the “Main Window” diagram,  “Application Overview”).

Alternatively, a right-mouse-button click into the »Device Models« field shows a context-menu, and from that you can select [Load New Device Model].

This context-menu also allows for selecting one of the loaded device models as the “active” one (i. e. the device model from which you select the available data objects to be mapped).

And of course, there is also the option to remove one of the loaded device models.

- Check the overall status in the Configuration window on tab »Device Models«. If the status is OK, proceed with the next step. If the status shows any problems, proceed as follows:
- Select the tab »Compatibility Check«. Here you can see which assignments are incompatible with your target device. Resolve the incompatibilities.



Resolve Device Incompatibilities

You have the following options to solve incompatibilities:

- Remove incompatible assignments from your mapping table.
- Adapt the settings so that they fit to your loaded device model(s).
- Then execute the page validation tests again (see above).

Add Notes - Add Metadata

You should now add some description to your protocol definition within the »Notes« tab of the Configuration window, so that it is possible to trace at a later time what has been done.

Moreover, we recommend to add author (“Config info”) and revision info (“Config version”) via the menu item [Edit / Version Info],  “4 Edit Menu”, or the button “[7]”,  Fig. 2.

Save the Mapping Definitions

In order to save the protocol definitions as a file select the menu item [File / Save]. In case that there are still any pending incompatibilities between your assignments and the active Device Model, a warning will pop up. You can either resolve the incompatible settings first (see above) or save the incompatible assignments. Please note that incompatible files cannot be transferred to the target device.

NOTICE!



A protocol definition file that does not fulfill the compatibility checks cannot be transferred to the target relay.

When all incompatible settings and validation errors are resolved, the assignments are ready to be transferred into the device.

5.4 Step 4: Connect the Target Device

Access the mapping file in *Smart view*. This can be done while the target protection device is connected:

- Connect the protection relay to the PC (please refer to the *Smart view* manual). Receive the parameter settings from the device using *Smart view*.

5.5 Step 5: Select the Mapping File

In order to load the mapping file proceed as follows:

1. In *Smart view*, open the menu item [Device planning].
2. A double-click on the entry »Scada . Protocol« opens the dialog for selecting the SCADA protocol to be used.

Of course, you have to set this to the same protocol as you have used for the mapping file.

3. Click on the button »Apply« to actually set the protocol.
 - ⇒ Within the menu branch [Device Para], a sub-menu becomes visible that belongs to the selected protocol. (The menu item [Device Para / IEC104], for example, or [Device Para / Modbus].)
 - ⇒ This sub-menu contains (among others) a menu item [Config. Data Obj.].
4. Double-click [Config. Data Obj.].
 - ⇒ A dialog window is opened that features a »SCADA Configuration Transfer« button. (See **(1)** in the example figure below.)
5. Clicking on this button opens another dialog, »SCADA Point Mapping Configuration«. There are two buttons there, **(2)** and **(a)** in the figure below.

For our purpose, we have to click button **(2)**, »Select a SCADA Mapping File from Disk and send it to the connected Device.«.

⇒ Then a file-select dialog opens.

6. Navigate to the *.HptSMap file that keeps the required SCADA definitions and click »Open«.
 - ⇒ *Smart view* opens and checks the *.HptSMap file. If it is compatible with the connected protection device a dialog asks the user whether the protocol definitions shall be transferred to the protection device **(3)**.
7. After clicking »yes« (and entering the password for the access level »Supervisor-Lv3«) the data is transferred.
 - ⇒ Afterwards, the user is informed about the success **(4)**.
8. The user may now click »Close« **(5)** in the »SCADA Point Mapping Configuration« dialog, to return to the *Smart view* main window.
9. Finally the user-specific mapping must be activated by the setting [Device Para / (protocol-name) / Config. Data Obj.] »Type of SCADA mapping« = "User-defined".

Do not forget to transfer all (or all changed) settings (from *Smart view*) to the protection device.

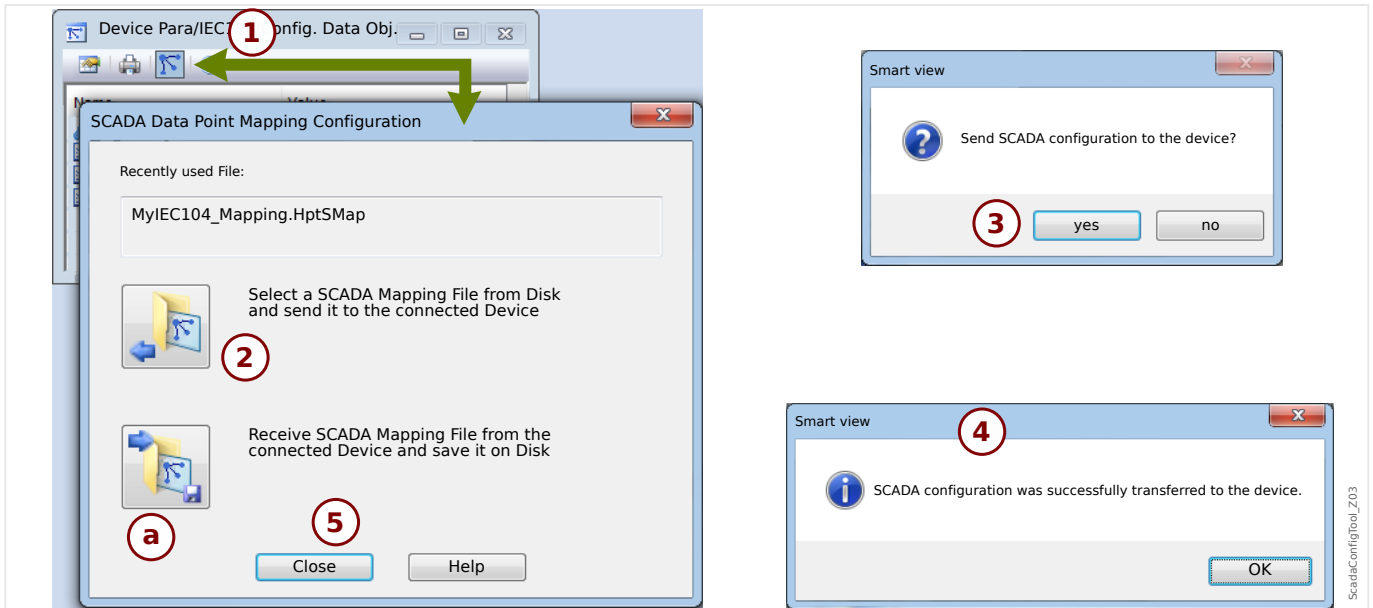


Fig. 4: Example of using Smart view to transfer the *.HptSMap to the protection device.



The other button, **(a)**, performs a transfer in the opposite direction: The protection device sends its (user-defined) SCADA protocol mapping to the »SCADA Point Mapping Configuration«, then a »Save as« file-dialog appears, that allows the user to create a new *.HptSMap file from these protocol definitions.

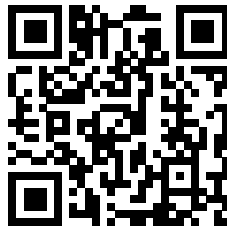
This download is not possible for the (factory default) standard mapping.

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Woodward Kempen GmbH
Krefelder Weg 47 • D-47906 Kempen (Germany)
Postfach 10 07 55 (P.O.Box) • D-47884 Kempen (Germany)
Telephone: : +49 (0) 21 52 145 1

Internet: — www.woodward.com

Sales

Telephone: : +49 (0) 21 52 145 331
Fax: : +49 (0) 21 52 145 354
Email: : SalesPGD_EMEA@woodward.com

Service

Telephone: : +49 (0) 21 52 145 600
Fax: : +49 (0) 21 52 145 455
Email: : SupportPGD_Europe@woodward.com

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