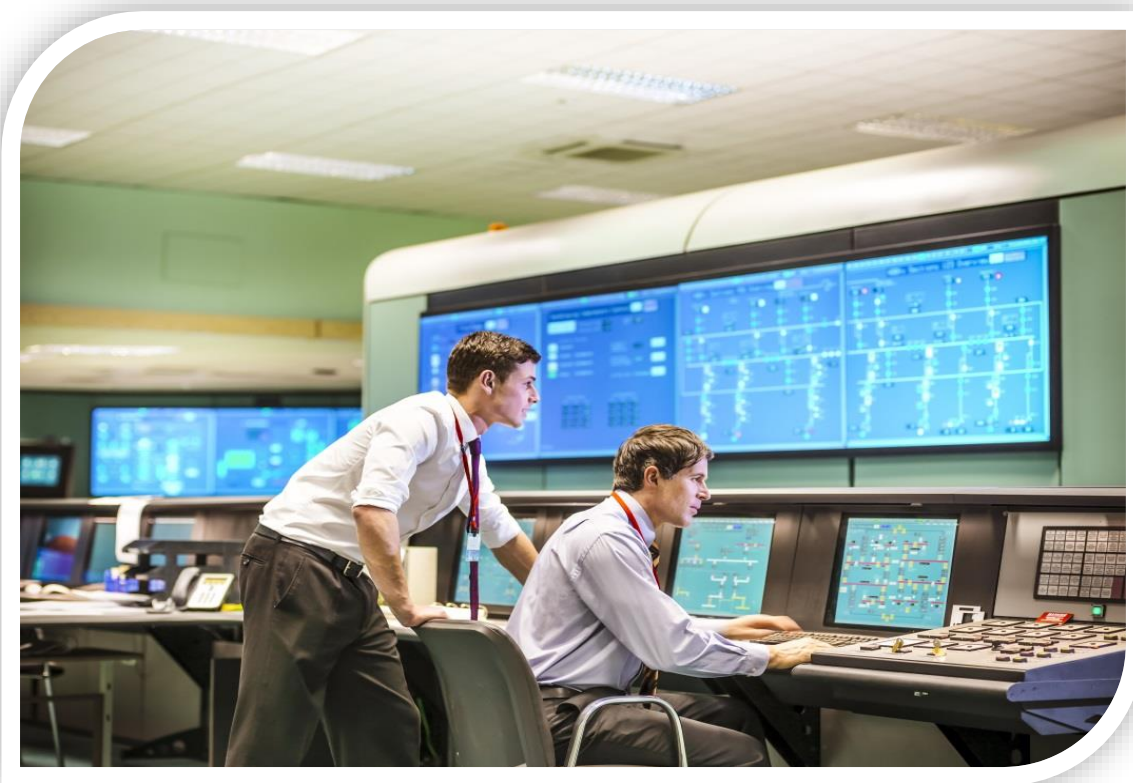


Application note

Modbus Power meters and Wiser for KNX

Reading basic and complete Modbus parameters from Acti9 Power meters via LUA scripts



Safety Information

Important Information



Read these instructions carefully before trying to install, configure, or operate this software. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

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Failure to observe this information can result in injury or equipment damage.

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1 Introduction

This application note describes Lua scripts which can read parameters from different Acti9 Modbus power meters via Wiser for KNX controller. Provided scripts can be used for easy configuration of power metering in new or existing installations with one or more power meters.

Customer value proposition

The customer value propositions correspond to real use cases to connect Wiser for KNX and Acti9 power meters. The power meters are used to measure electrical parameters of whole installation or just a part of it.

Power meters provide:

- Installation monitoring
- Alarming and consumption drifts
- Consumption monitoring
- Evaluation of energy items (cost, accounting, etc.)
- Logging of historical values of consumption
- Identifying harmonic disturbances

These electrical parameters are stored in registers and can be read or modified by Wiser for KNX. After reading from an appropriate register, this value will be converted to standard KNX data point type.

In this context, here are some identified possible use cases which can be implemented with this application note.

- Use case 1: One power meter is connected to Wiser for KNX
 - How to restore Wiser for KNX with list of KNX objects to read basic and complete registers
- Use case 2: One power meter is connected to Wiser for KNX
 - How to restore scripts for reading basic or complete registers without list of KNX objects
- Use case 3: More than one power meter is connected to Wiser for KNX
 - How to use scripts for reading registers from different power meters
- Use case 4: Customization of scripts via optional parameters
 - How to customize provided script to achieve better optimization of data performance to preserve KNX network bandwidth

Competencies

There are few necessary competencies to follow procedures mentioned in this application note. It is mandatory to have knowledge of basic Wiser for KNX configuration and knowledge of Lua scripting language in the content described in the Product manual. You also need to have knowledge of Modbus power meters described in user manual of each single power meter.

System prerequisites

Procedures contained in this application note were tested on the Wiser for KNX with firmware version 2.1.0

Product name	version
Wiser for KNX	2.1

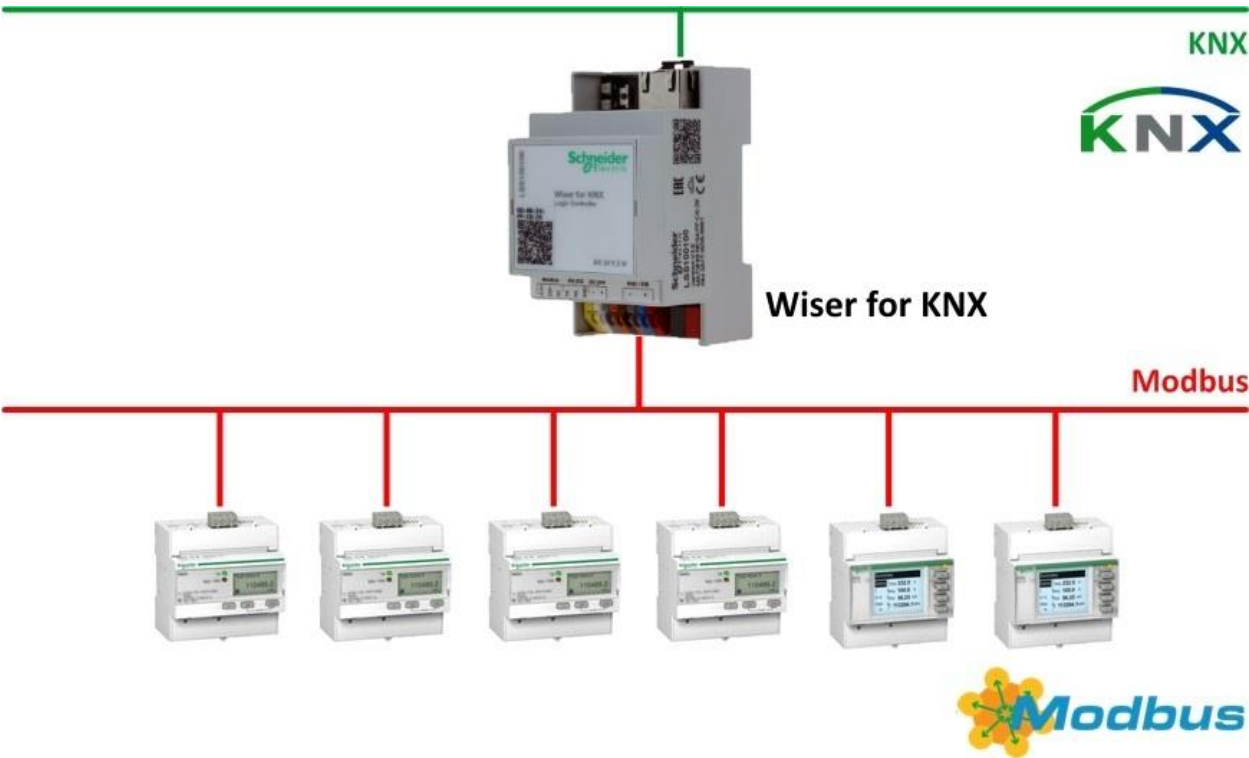
Table 1: System prerequisites

2 Design

There are six Modbus power meters (Acti9 range) installed in architecture (see Table 2) and connected to Wiser for KNX. There is no problem to use only one power meter or more different power meters in real architecture. Different usage is described based on use cases in chapter 1.

Commercial number	Type	Description
A9MEM3150	iEM3150	3 – phase energy meter
A9MEM3155	iEM3155	3 – phase energy meter
A9MEM3250	iEM3250	3 – phase energy meter
A9MEM3255	iEM3255	3 – phase energy meter
METSEPM3250	PM3250	3 – phase energy meter
METSEPM3255	PM3255	3 – phase energy meter

Table 2: Installed power meters in architecture



Picture 1: Power meters connected to Wiser for KNX via Modbus

3 Configuration

Power meters are connected to Wiser for KNX via Modbus connection. Wiser for KNX can read all parameters of Modbus power meters and process them. Provided Lua scripts read parameters and update objects determined KNX group addresses.

For using the provided scripts, it is necessary to follow the next steps described in the following chapters.

1) Power meters configuration

First, it is necessary to configure power meters according to the procedures described in instructions, such as communication, speed, wiring parameters etc.

2) Wiser for KNX configuration

Basic configuration of Wiser for KNX according to the product manual. Setting of IP address, date and time, user access etc.

3) Restore of power meters and configuration options

Procedures to restore scripts and customization of scripts according to user needs like Modbus connection settings, Modbus registers settings etc. This third step is described in deep in the following chapters.

Lua scripts for reading Modbus parameters

Provided Lua scripts are divided into two types. The first type of Lua script is designed for reading and processing basic set of Modbus parameters from each power meter. The second type of Lua scripts is designed for reading and processing complete (all) Modbus parameters from each power meter.

Provided Lua scripts are located in a *.zip file with the following structure

- registers_basic
 - backup
 - script
- registers_complete
 - backup
 - script

There are Lua scripts for specified power meter with defined function (reading of complete set of registers or just basic registers) in the backup and script folder.

The backup folder is used for complete Wiser for KNX project restore (script and list of KNX objects). The script folder is used for scripts restore without list of KNX objects.

Commercial number	Type	Script files for basic registers	Script files for complete registers
A9MEM3150	iEM3150	iem3150_basic registers.tar.gz scripting-iem3150_basic registers.tar.gz	iem3150_complete registers.tar.gz scripting-iem3150_complete registers.tar.gz
A9MEM3155	iEM3155	iem3155_basic registers.tar.gz scripting-iem3155_basic registers.tar.gz	iem3155_complete registers.tar.gz scripting-iem3155_complete registers.tar.gz
A9MEM3250	iEM3250	iem3250_basic registers.tar.gz scripting-iem3250_basic registers.tar.gz	iem3250_complete registers.tar.gz scripting-iem3250_complete registers.tar.gz
A9MEM3255	iEM3255	iem3255_basic registers.tar.gz scripting-iem3255_basic registers.tar.gz	iem3255_complete registers.tar.gz scripting-iem3255_complete registers.tar.gz
METSEPM3250	PM3250	pm3250_basic registers.tar.gz scripting-pm3250_basic registers.tar.gz	pm3250_complete registers.tar.gz scripting-pm3250_complete registers.tar.gz
METSEPM3255	PM3255	pm3255_basic registers.tar.gz scripting-pm3255_basic registers.tar.gz	pm3255_complete registers.tar.gz scripting-pm3255_complete registers.tar.gz

Table 3: list of scripts for reading Modbus registers from Acti9 power meters

3.1 How to work with provided Lua scripts

The provided scripts for reading Modbus parameters are unique according to power meter type. Each power meter has its own Lua script suitable for Wiser for KNX which must be restored and configured. In following chapters, will be described what type of scripts is suitable for specific situation and how user can restore and configure scripts to achieve best results.

There are differences in application of basic and complete scripts. Scripts for basic registers automatically create KNX addresses based on user option while scripts for complete registers use a fixed list of KNX addresses.

Note: The provided scripts read Modbus parameters and make internal update of KNX objects by default. For write Modbus parameter to KNX network please refer to chapter 3.1.5.

3.1.1 Restore basic registers script

Scripts for reading basic registers support data point formats UTF8, Int16, Int32, Int64, Float32, Bitmap, 4QFPPF. For details about data point format please refer to instruction of specified power meter.

Date/Time format is not supported.

Basic registers scripts contain the ability to read the most used Modbus parameters like voltage, current, power etc. User can restore whole Wiser for KNX (scripts and KNX objects) or only scripts and build own list of KNX objects.

Steps how to restore Wiser for KNX configuration and to use basic registers scripts:

- 1) Open web browser and log on Wiser for KNX controller
- 2) Restore Wiser for KNX project *Configurator* » *Utilities* » *Restore*

In Wiser for KNX Configurator page

- Left click on [Utilities](#) ¹
- Left click on [Restore](#) ²



Picture 2: Restore of Wiser for KNX project

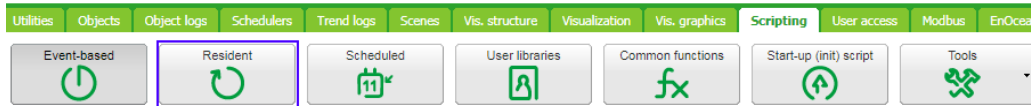
Restore Wiser for KNX with suitable script. Scripts are located in *register_basic* » *backup* folder.

Note: It is necessary to make refresh the webpage after scripts restore.


- 3) Initial Modbus configuration via restored Lua script

There are a few configuration steps after Wiser for KNX restore which must be done before activating of script.

In Wiser for KNX Scripting page under Resident scripts



Picture 3: Resident scripts

- Open restored script via edit icon 

Configuration parameters must be modified against to default settings.

```
local pwm = MbPwmRTU{  
  address = "/dev/RS485",  
  speed = 19200,  
  parity = "E",  
  databits = 8,  
  stopbits = 1,  
  duplex = "H",  
  slaveAddress = 1,  
  KNXStartAddr = "1/1/",  
}
```

Configuration parameters which are mentioned above are in default and must be modified according to the configuration which is set in specified power meter. For more instructions on how to configure power meter see instructions.

Note: KNXStartAddr could be modified should it be required need especially in case of use in existing installations. Default format is main/middle/group. Group address is "1" by default and is automatically incremented +1 according to amount of Modbus registers.

KNX address format for automatic generation of KNX address with increment of group address:

- 1) KNXStartAddr = "1/2/"

Generation of KNX addresses will start on group address 1 and main/middle part of KNX address is open to modification according KNX rules.

- 2) KNXStartAddr = "1/2/10"

Generation of KNX addresses will start on group address 10 and main/middle part of KNX address is open to modification according KNX rules.

- 3) KNXStartAddr = "1/2"

Generation of KNX addresses will start on group address 1 and main/middle part of KNX address is free to modify according KNX rules. No need to use „/" character.

There is also option to modify list of registers in case of user needs. Just delete or add registers which are suitable to use.

```
local regTable = pwm:allocRegisters {
  { addr = 3028, type = 'Float32'}, -- Voltage L1-N
  { addr = 3030, type = 'Float32'}, -- Voltage L2-N
  { addr = 3032, type = 'Float32'}, -- Voltage L3-N
  { addr = 3000, type = 'Float32'}, -- I1: phase 1 current
  { addr = 3002, type = 'Float32'}, -- I2: phase 2 current
  { addr = 3004, type = 'Float32'}, -- I3: phase 3 current
  { addr = 3110, type = 'Float32'}, -- Frequency
  { addr = 3084, type = 'Float32'}, -- Power Factor Total
  { addr = 3060, type = 'Float32'}, -- Active Power Total
  { addr = 3204, type = 'Int64'}, -- Total Active Energy Import
}
```













4) Activate resident script for related power meter

After configuration of settings mentioned in previous steps the script can be activated by clicking on the activation icon .

The script is running when the activation icon changes to .

5) Check relevant information is depicted in list of objects

When the script for reading Modbus parameters is running, the parameters can be checked in the Object tab.

Utilities	Objects	Object logs	Schedulers	Trend logs	Scenes	Vis. structure	Visualization	Vis. graphics	Scripting	User access	Modbus	E
Object filter												
Name or group address:												
Data type:												
Tags:												
Match mode:												
<input checked="" type="radio"/> All tags <input type="radio"/> Any tag												
<input type="button" value="Apply filter"/> <input type="button" value="Cancel"/>												
Group address	Object name	IP > Loc ...	Loc > IP ...	Event scr...	Data type	Current value						
7/1/1	Voltage L1-N	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	232.560 V						
7/1/2	Voltage L2-N	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	116.610 V						
7/1/3	Voltage L3-N	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	116.610 V						
7/1/4	I1 phase 1 current	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	0.220 A						
7/1/5	I2 phase 2 current	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	0.000 A						
7/1/6	I3 phase 3 current	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	0.000 A						
7/1/7	Frequency	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	50.010 Hz						
7/1/8	Total power factor	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	0.545						
7/1/9	Active power	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	0.030						
7/1/10	Total Active energy import	<input type="checkbox"/>	<input type="checkbox"/>		12. 4 byte unsigned i...	48 Wh						
7/1/20	Active power (W)	<input type="checkbox"/>	<input type="checkbox"/>		14. 4 byte floating p...	30.000 W						
7/1/30	Actual Price	<input type="checkbox"/>	<input type="checkbox"/>		09. 2 byte floating p...	0.07 €/h						

Picture 4: list of KNX objects

Note: Be careful to not overload KNX bus with writing too many values to KNX objects. Information how to optimize data performance is described in chapter 3.1.5

3.1.2 Restore complete registers scripts

Provided scripts for reading complete Modbus parameters are based on scripts for reading basic registers. Scripts for reading complete registers support datapoint formats UTF8, Int16, Int32, Int64, Float32, Bitmap, 4QFPPF. For details about datapoint format refer to instruction of specified power meter.

Date/Time format is not supported.

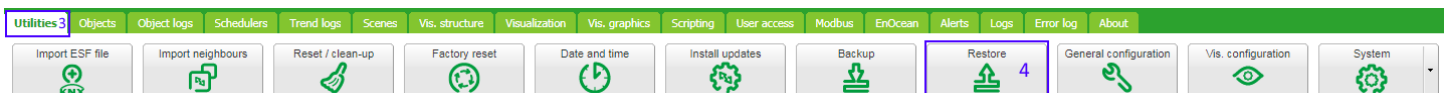
Complete registers scripts contain ability to read all Modbus parameters according Modbus registers table listed in instructions for specified power meter. User can restore whole Wiser for KNX (scripts and KNX objects) or only scripts and build their own list of KNX objects.

Steps how to restore Wiser for KNX configuration and to use complete registers scripts:

- 1) Open web browser and log on Wiser for KNX controller
- 2) Restore Wiser for KNX project *Configurator* » *Utilities* » *Restore*

In Wiser for KNX Configurator page

- Left click on [Utilities](#) ³
- Left click on [Restore](#) ⁴



Picture 5: Restore of Wiser for KNX project

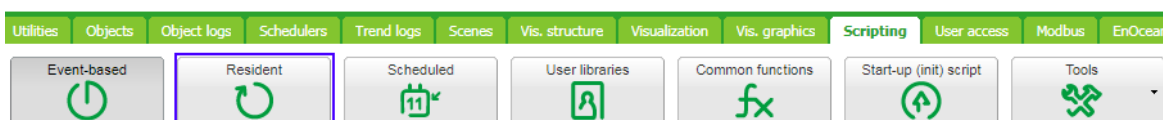
Restore Wiser for KNX with script. Scripts are located in *register_complete* » *backup* folder.

Note: It is necessary to make refresh of webpage after scripts restore.


- 3) Initial Modbus configuration via restored Lua script

There are a few configuration steps after Wiser for KNX restore which must be done before activating of script.

In Wiser for KNX Scripting page under Resident scripts



Picture 6: Resident scripts

- Open restored script via edit icon 

Configuration parameters must be modified against to default settings.

```
local pwm = MbPwmRTU{
  address = "/dev/RS485",
  speed = 19200,
  parity = "E",
  databits = 8,
  stopbits = 1,
  duplex = "H",
  slaveAddress = 1,
}
```

Configuration parameters which are mentioned above are in default and must be modified according configuration which was set in specified power meter. For further instructions, how to configure power meter see instructions.

Note: There is missing KNXStartAddr against initial configuration of scripts for reading basic registers because this KNX address is set in registers table.

There is also the option to modify list of registers in case user needs. Just delete registers which are not necessary to use.

```
local regTable = {
  -- Date / Time
  { addr=1845, type="UInt16", KNX="1/1/1"},
  { addr=1846, type="UInt16", KNX="1/1/2"},
  { addr=1847, type="UInt16", KNX="1/1/3"},
  { addr=1848, type="UInt16", KNX="1/1/4"},
  -- Wiring Setup
  { addr=2016, type="UInt16", KNX="1/1/5"},
  { addr=2017, type="UInt16", KNX="1/1/6"},
  --Energy Pulse Output Setup
  { addr=2129, type="UInt16", KNX="1/1/7"},
  { addr=2132, type="Float32", KNX="1/1/8"},
  --Meter Data
  { addr=3000, type="Float32", KNX="1/1/9"},
  -- Year
  -- Month & Day
  -- Hour & Minute
  -- Milisecond
  -- Power System
  -- Nominal Frequency
  -- Pulse Duration
  -- Pulse Constant
  -- I1: phase 1 current
}
```

Note: All registers must be specified together with KNX address.

- 4) Activate resident script for related power meter

After configuration of settings mentioned in previous steps the script can be clicked on the activation icon .

The script is running when Activation icon changes to .

- 5) Check relevant information is depicted in the list of objects

When script for reading Modbus parameters is running the parameters can be checked in Object tab (see chapter 3.1.1 for picture).

Note: Be careful to not overload KNX bus with writing too many values to KNX objects. Information how to optimize data performance is described in chapter 3.1.5

3.1.3 Restore scripts without list of KNX objects for reading basic and complete Modbus registers

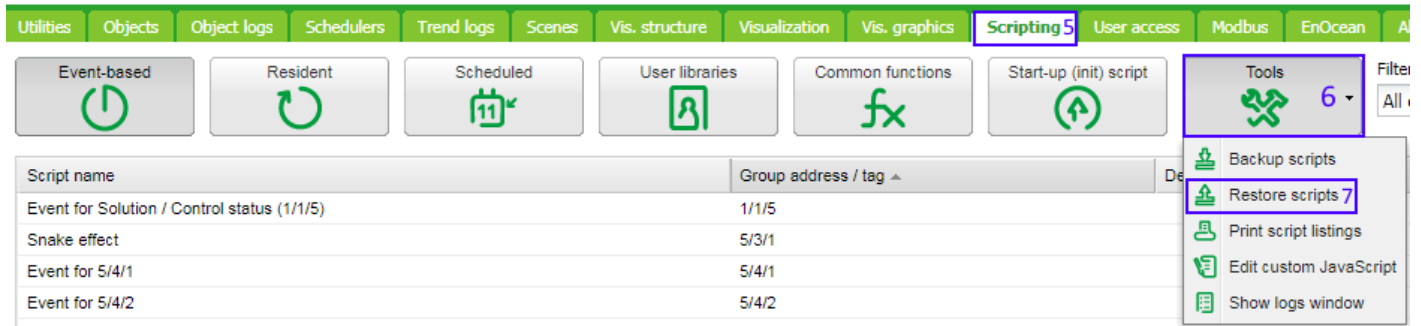
There is also possibility to restore Lua scripts for reading basic and complete registers without pre-set list of KNX objects. This can be useful for existing projects.

Steps how to restore Wiser for KNX configuration and to use complete registers scripts:

- 1) Open web browser and log on Wiser for KNX controller
- 2) Restore Wiser for KNX project *Configurator » Utilities » Scripting » Tools » Restore scripts*

In Wiser for KNX Configurator page

- Left click on [Scripting](#) ⁵
- Left click on [Tools](#) ⁶
- Left click on [Restore scripts](#) ⁷




Picture 7: restore of scripts without preset KNX objects

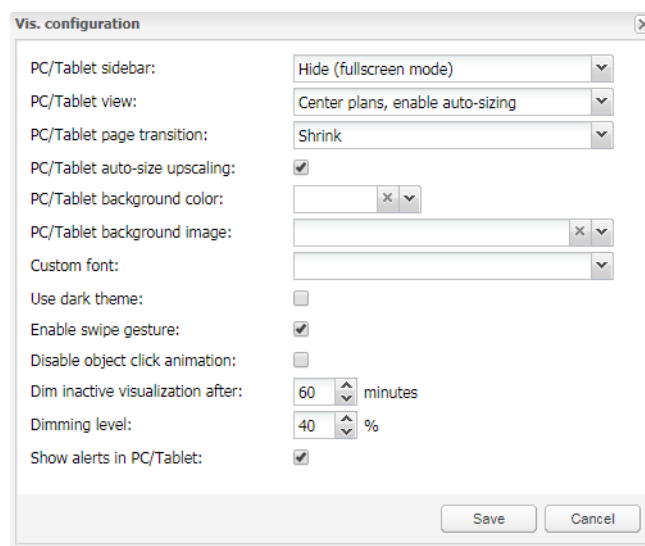
3) Initial Modbus configuration via restored Lua script

Initial Modbus configuration procedure is the same as for restore of Wiser for KNX project. Please refer to previous chapters to find more details. Initial configuration depends on the choice of script for reading basic or complete registers.

4) Create KNX objects

For visualization of read Modbus parameters it is necessary to build KNX object lists. This can be done via Object tab  Add new object.

Click on icon Add new object open window to create KNX object.



Picture 8: Create KNX object

After filling these fields in the KNX object is created and can visualise value from Modbus register. This procedure must be followed for all Modbus registers listed in register table in script.

5) Activate resident script for related power meter

After configuration of settings mentioned in previous steps the script can be activated by clicking on the activation icon .

The script is running when the Activation icon changes to .

6) Check relevant information is shown on list of objects

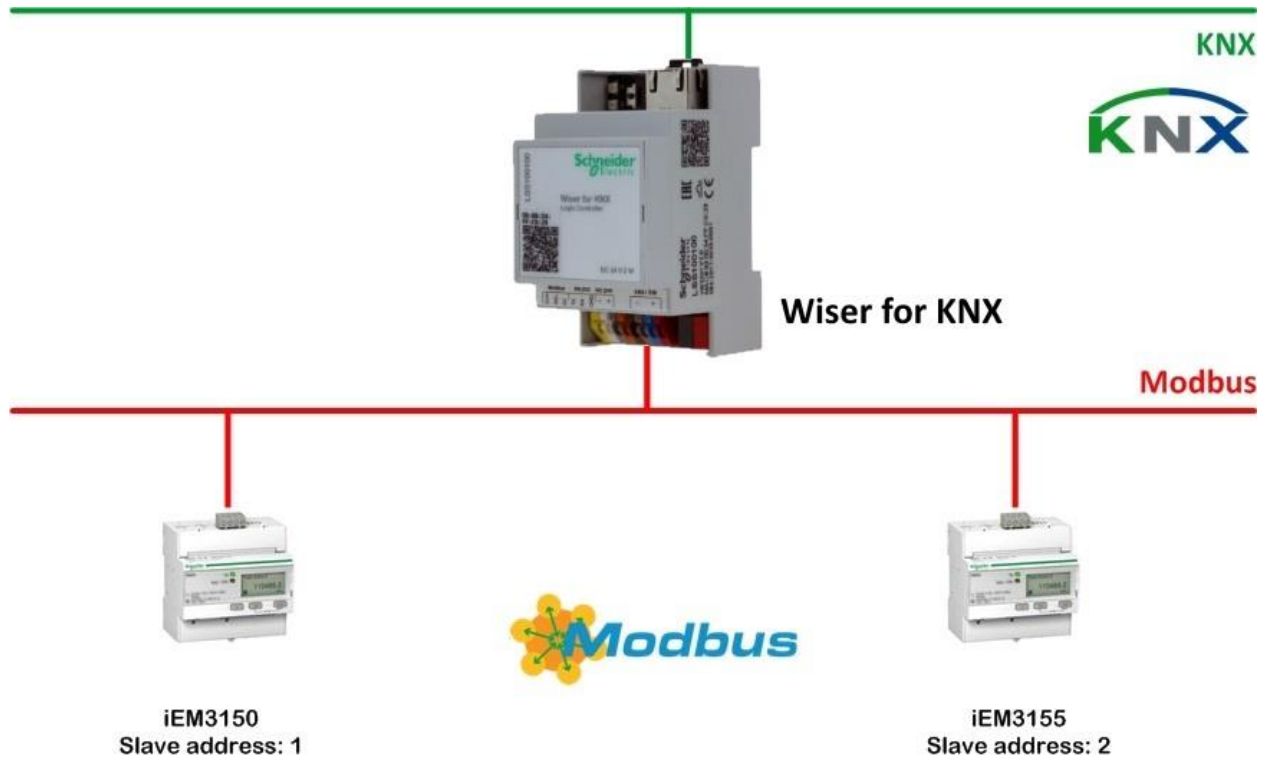
When the script for reading Modbus parameters is running, the parameters can be checked in the Object tab.

Note: Be careful to not overload the KNX bus with writing too many values to KNX objects. Information on how to optimize data performance is described in chapter 3.1.5

Note: Scripts for reading basic and complete registers are located in the script folder in *.zip file.

3.1.4 Restore scripts for more power meters in installation

Wiser for KNX can read data from a maximum of 32 Modbus power meters located in the installation. In this use case, we want to read parameters from 2 different power meters iEM3150 and iEM3155. In this case, the restoration of scripts should be used instead of the whole project. KNX objects must be built manually.



Picture 9: Architecture for reading registers from 2 power meters

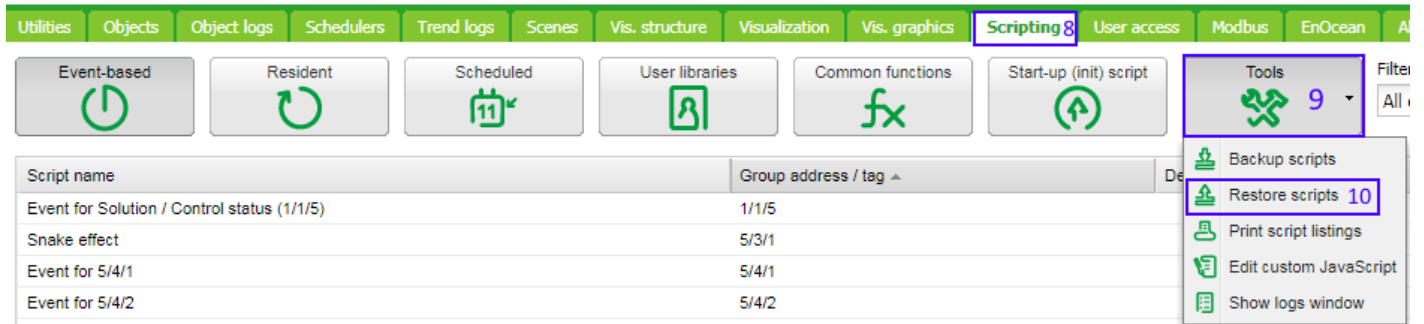
Steps how to restore Wiser for KNX scripts for reading basic registers.

- 1) Open web browser and log on Wiser for KNX controller
- 2) Restore Wiser for KNX project *Configurator* » *Utilities* » *Scripting* » *Tools* » *Restore scripts*

In Wiser for KNX Configurator page

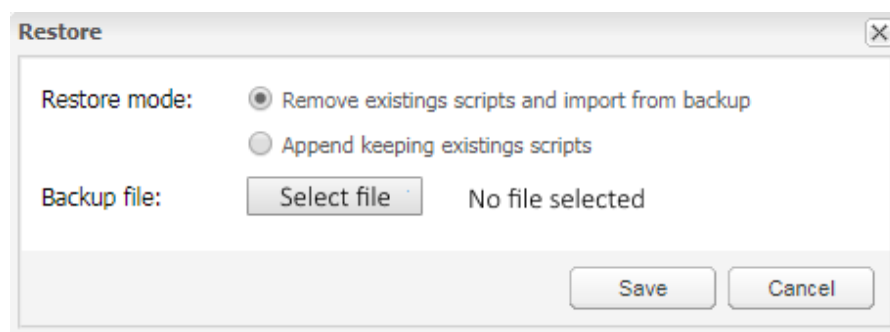
- Left click on [Scripting](#)⁸
- Left click on [Tools](#)⁹
- Left click on [Restore scripts](#)¹⁰

Scripts are located in *register_basic* » *scripts* folder



Picture 10: restore of scripts without preset KNX objects

Note: For first power meter use Restore mode (Remove existing scripts and import from backup). For other power meters change option to “Append keeping existing scripts”.



Picture 11: Restore options

Two script for power meters iEM3150 and iEM3155 are now available.

3) Modify scripts on Scripting page

- Open Editor for first power meter [iEM3150¹¹](#)
 - Set configuration parameters and list of registers

Script name	Sleep interval (seconds)	Description	Category	Editor	Active	Dupli...	Delete
iem3150	60	iEM3150_basic registers	Modbus	11			
iem3155	60	iEM3155_basic registers	Modbus	12			

Picture 12: List of scripts for power meters

- Open Editor for second power meter [iEM3155¹²](#)
 - Set configuration parameters and eventually list of registers

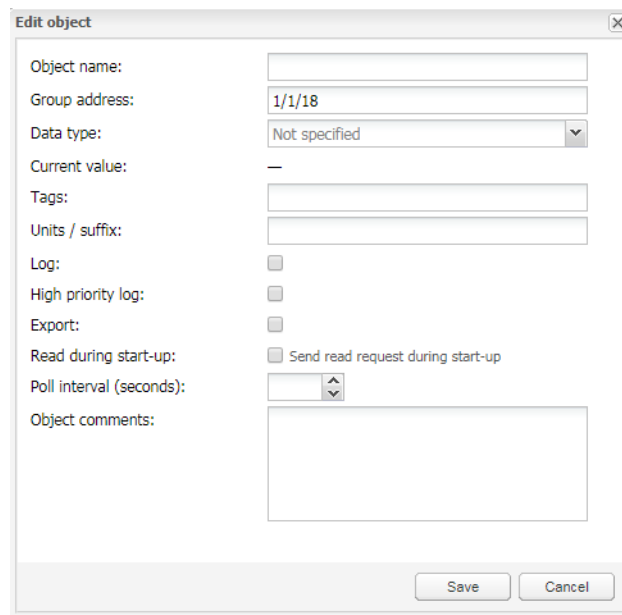
Note: Configuration is described in chapter 3.1.1 Restore basic registers script. Configuration parameters depends on settings of specific power meters.

4) Create KNX objects

For visualization of read Modbus parameters it is necessary to build KNX object lists. This can be done via

Object tab .



Click on icon Add new object, open window to create KNX object.



Picture 13: Create KNX object

After filling these fields the KNX object is created and can visualise values from the Modbus register. This procedure must be done for all Modbus registers listed in register table in scripts.

5) Activate resident scripts for related power meter

After configuration of settings mentioned in previous steps the scripts can be activated by clicking on the activation icon . The script is running when Activation icon changes to .

After this step reading of Modbus registers from power meters is running.

Note: If reading from more than one power meter use semaphore functionality. One power meter locks the semaphore and other power meters must wait for unlock. In this case the script can start reading after a delay.

Semaphore lock issue is visible on tab Error log **Error log**. In case semaphore is locked, wait for automatic unlock.

The scripts for reading complete registers can also be used. The difference is in the part where scripts are modified according to specific power meters. The KNX address in this case is fixed so there is no need to set KNXStartAddr.

3.1.5 How to customize provided scripts to achieve better optimization of data performance

Each power meter has many Modbus registers where data are stored. Reading of all data is not necessary in most use cases. The user could add parameters in script to preserve KNX network bandwidth.

1) Set sleep interval of each script

It is not necessary to read data from power meter every second. Sleep interval is set to 60 seconds by default. Sleep interval settings depends on number of power meters in installation and number of registers.

2) Change of value

For each Modbus register with Float32 or Int datapoint type the parameter covDelta can be set.

The Float32 datapoint type has the parameter covDelta (change of value Delta). This parameter has an affect on the intensity of update or write Modbus parameter to KNX objects. Script calculate difference between previous and actual value and if the difference is over covDelta parameter then the value is updated or written to KNX. Default value for covDelta is 0.1. In case of need just change the covDelta value.

```
{ addr = 3060, type = 'Float32', covDelta = 0.3}, -- Active Power Total
```

The Int datapoint type can also use the covDelta parameter. There is no default value for covDelta for Int datapoint type.

Note: There is a possibility to skip covDelta parameter with force parameter:

```
{ addr = 3060, type = 'Float32', covDelta = 0.3, force = true},
```

3) Write to KNX bus

To preserve KNX network bandwidth all KNX objects in Wiser for KNX are updated by default. For write value to KNX network parameter flags can be used.

```
{ addr = 3060, type = 'Float32', flags="w" }, -- Active Power Total
```

This parameter has an impact on speed of KNX network and should be used where appropriate.

Example of modification behaviour for register 3060 – Active power total which is write to KNX network only when difference between old and new value is more than 0.3.

```
{ addr = 3060, type = 'Float32', covDelta = 0.3, flag="w" }, -- Active Power Total
```

4 Conclusion

Procedures contained in this application note describe usage of Lua scripts for reading of Modbus registers from different Acti9 power meters. The provided scripts are based on use cases mentioned in Introduction chapter and could be use in different scenarios allow to read basic or complete set of Modbus registers depending on project request.

5 Appendix

5.1 Glossary

The following table describes the acronyms and defines the specific terms used in this document.

Abbreviation	Description
Lua	Lightweight multi-paradigm programming language designed as a scripting language with extensible semantics
Modbus	Serial communications protocol for use with its programmable logic controllers (PLCs)

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