Application Note

Green. Smart. Wireless.
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WAGO-I/O-SYSTEM 750
EnOcean Equipment Profile (EEP)
Connecting EnOcean Wireless Sensors / Actuators
Using the WAGO EnOcean Library

Version: 12.06.2013

WAGO
INNOVATIVE CONNECTIONS

WAGO Kontakttechnik GmbH & Co. KG

Hansastraße 27
D-32423 Minden

Phone: +49 (0) 571/8 87 – 0
Fax: +49 (0) 571/8 87 – 1 69

E-mail: info@wago.com

Web: http://www.wago.com

Technical Support

Phone: +49 (0) 571/8 87 – 5 55
Fax: +49 (0) 571/8 87 – 85 55

E-mail: support@wago.com

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

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1   Important Notes

To ensure fast installation and start-up of the units, we strongly recommend that the following information and explanations are carefully read and adhered to.

1.1   Legal Principles

1.1.1   Subject to Change

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1.1.3   Personnel Qualification

The use of the product described in this document is exclusively geared to specialists having qualifications in SPS programming, electrical specialists or persons instructed by electrical specialists who are also familiar with the appropriate current standards. WAGO Kontakttechnik GmbH & Co. KG assumes no liability resulting from improper action and damage to WAGO products and third-party products due to non-observance of the information contained in this document.

1.1.4   Intended Use

For each individual application, the components are supplied from the factory with a dedicated hardware and software configuration. Modifications are only admitted within the framework of the possibilities documented in this document. All other changes to the hardware and/or software and the non-conforming use of the components entail the exclusion of liability on part of WAGO Kontakttechnik GmbH & Co. KG.

Please send your requests for modified and new hardware or software configurations directly to WAGO Kontakttechnik GmbH & Co. KG.

1.2 Scope of Validity

This application note is based on the stated hardware and software from the specific manufacturer, as well as the associated documentation. This application note is therefore only valid for the described installation.
New hardware and software versions may need to be handled differently.

Please note the detailed description in the specific manuals.

1.3 Symbols

NOTE	**NOTE**
	Boundary conditions that must always be observed to ensure smooth operation.

Note	**Important note:**
	Routines or advice for efficient use of a device and software optimization.

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

1.4   Number Notation

Table 1: Number notation

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0 x 64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots

1.5   Font Conventions

Table 2: Font conventions

Font type	Explanation
italic	Names of paths and files are displayed in italics, e.g.: *C:\Programs\WAGO-I/O-CHECK*
Menu	Menu options are displayed e.g. **Save**
>	A "greater than" symbol between two names denotes the selection of a menu option from a menu, e.g.: **File > New**
Input	Designation of input or optional fields are displayed in bold; e.g.: **Start of measurement range**
"Value"	Input or selection values are displayed in quotation marks; e.g.: Enter the value "4mA" under **Start of measurement range**.
[Button]	Button labels in the dialogs are displayed in bold and enclosed in square brackets, e.g.: **[Input]**
[Key]	Key labels on the keyboard are displayed in bold and enclosed in square brackets, e.g.: **[F5]**

2 Description

The fundamental way of carrying out the communication between the WAGO-I/O-SYSTEM and the various EnOcean wireless sensors with the help of the *EnOcean_05.lib* library is described in this application note.

3 Components

Table 3: Components

Supplier	Qty.	Description	Item No.
WAGO	1	Programmable fieldbus controller	750-880
WAGO	1	RS-232/RS-485 terminal (configurable)	750-652
WAGO	1	End module	750-600
WAGO	1	WAGO-I/O-PRO V2.3	759-333
Thermokon	1	EnOcean-receiver/sender with RS-485 interface STC65-RS485 EVC	STC65-RS485 EVC
Thermokon	1	PTM200 wireless transmitter	-
Thermokon	1	EasySens SRW01 window contact	-
Thermokon	1	Thermokon SR04PST room operating panel	-

Optional components:

Table 4: Optional components

Supplier	Qty.	Description	Item No.
WAGO		USB communication cable	750-923

Note:	**Node structure**
	The node structure described is only one example of how communication with the EnOcean sensors can be realized. The modules may be expanded as required by the respective application.

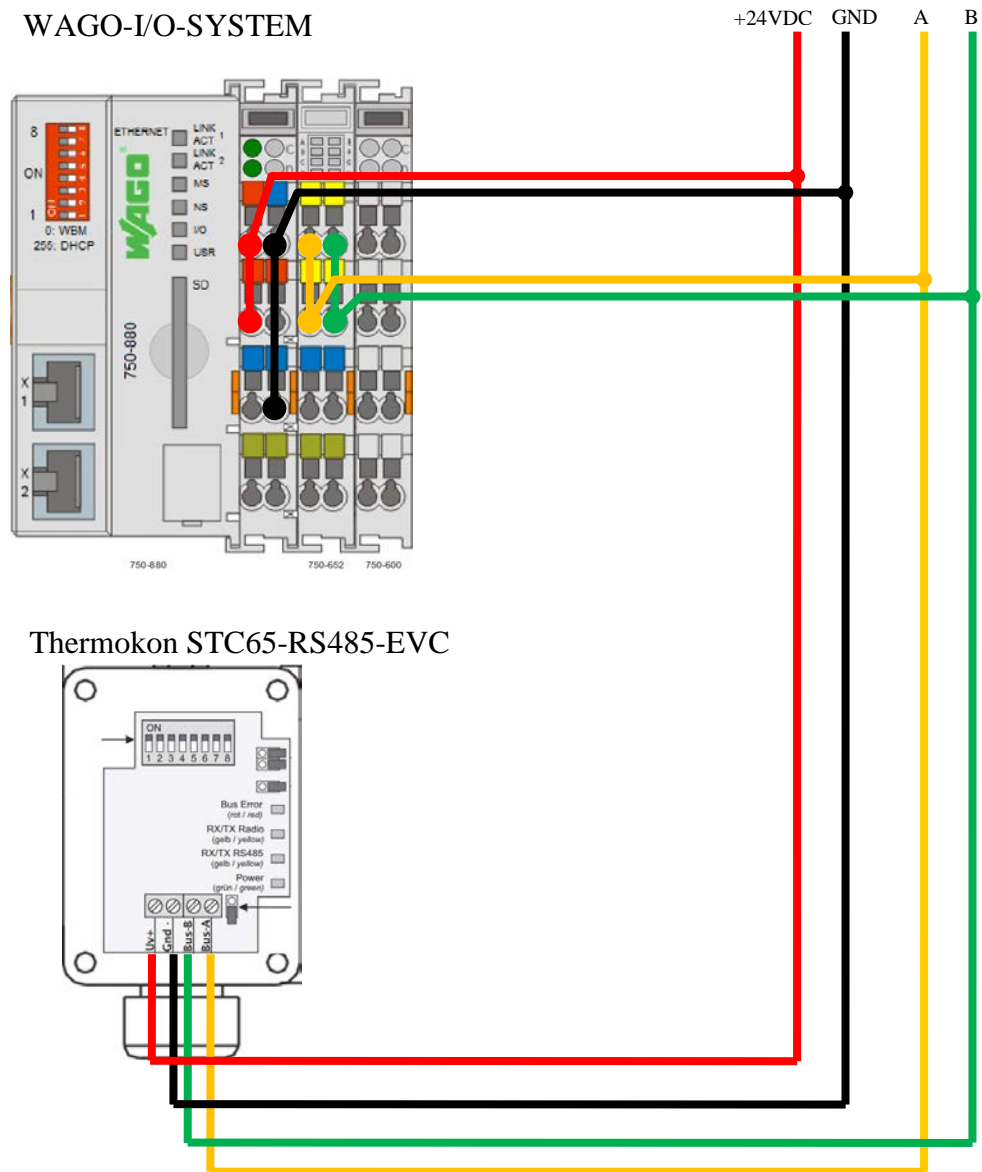| Information	**Additional information**
	Additional information about the EnOcean STC65-RS485 EVC gateway and wireless sensors is available at www.thermokon.de.

4 Setup

WAGO-I/O-SYSTEM

Figure 1: Connection diagram WAGO-I/O-SYSTEM/ EnOcean devices

NOTE

Thermokon STC65-RS485 EVC
Only one gateway per serial module should be integrated. If range problems arise between the sender and receiver during installation, use of a repeater is recommended.

Note:	**Thermokon SRC65-RS485 EVC**
	The S**R**C65-RS485-EVC gateway can be used as an alternative. The SRC65-RS485-EVC gateway only allows reception of radio telegrams that correspond to the EnOcean communication protocol.
	The S**T**C65-RS485-EVC gateway also allows transmission of EnOcean telegrams.

5   EnOcean Equipment Profile (EEP)

5.1   Structure of an EEP

By standardizing the communication profiles (EnOcean Equipment Profile, EEP) the interoperability of the terminals based on EnOcean technology can be guaranteed. In this way, for example, sensors from one device manufacturer can communication with receiver gateways from another manufacturer. The standard can be downloaded at www.enocean.com.

EEP2.0: ORG   -FUNC- TYPE
EEP2.1: RORG -FUNC- TYPE
Range (hex): 00..FF   - 00..3F -   00..7F

Figure 2: Structure of an EEP

An EEP consists of three fields:

1. **RORG** or **ORG** number describes the telegram type.

2. **FUNC** number describes the functionality of the data bytes.

3. **TYPE** number describes the properties of the device/device type.

The field values are displayed as hexadecimal numbers. The range of values is limited by the bits available (see Figure 2).

For the new EEP2.1, the telegram type is relabeled RORG number instead of ORG number (see Table 5).

Table 5: RORG numbers

Telegram	RORG	ORG	Description
RPS	F6	05	Repeated Switch Communication
1BS	D5	06	1 Byte Communication
4BS	A5	07	4 Byte Communication
VLD	D2	=RORG	Variable Length Data
MSC	D1	=RORG	Manufacturer Specific Communication
ADT	A6	=RORG	Addressing Destination Telegram
SM_LRN_REQ	C6	=RORG	Smart Ack Learn Request
SM_LRN_ANS	C7	=RORG	Smart Ack Learn Answer
SM_REC	A7	=RORG	Smart Ack Reclaim
SYS_EX	C5	=RORG	Remote Management

6 Example Program

6.1 Tasks

This application note describes how to connect various sensors that operate based on EnOcean wireless technology to the WAGO-I/O-SYSTEM. The EnOcean STC65-RS485-EVC gateway from Thermokon is connected to a 750-652 serial module of the WAGO-I/O-SYSTEM. The application program is based on the *Enocean_05.lib* library.

6.2 Programming

```
0001 PROGRAM Thermokon_STC
0002 (************************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Master Funktion block for communication with EnOcean over RS485 using
0007           Thermokon EnOcean Gateway STC65-RS485 EVC.
0008
0009 Version:    1.0
0010 Date:       25.03.2013
0011 ************************************************************)
0012 VAR
0013     STC65_RS485: FbThermokonSTC65_RS485_EVC;
0014         bError: BYTE;
0015 END_VAR
0016
```

```
0001 (*Thermokon EnOcean Gateway STC65-RS485 EVC*)
                        STC65_RS485
                  ┌─────────────────────────────┐
                  │  FbThermokonSTC65_RS485_EVC  │
              2 ──┤ bCOM_PORT_NR          bError ├──── bError
      typEnocean ─┤ typEnocean ▷                 │
                  └─────────────────────────────┘
```
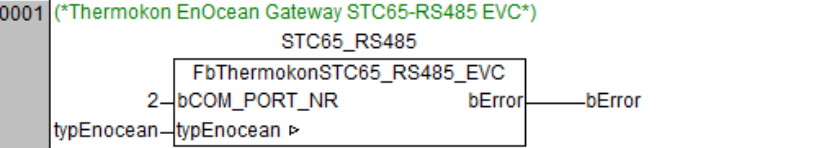
Figure 3: Program for receiving/sending EnOcean telegrams

Figure 3 shows the basic structure for programming an application with an EnOcean STC65-RS485 EVC wireless gateway from Thermokon. A requirement for communication with the gateway is the **FbThermokonSTC65_RS485_EVC** function block.

The fieldbus controller detects and assigns the port numbers of the connected serial I/O modules independently from the left beginning with COM2. The service interface on the controller is always COM1.

To address the function block to the proper RS-485 module, the corresponding number (e.g. "2" for COM2) must be entered as a constant at the **bCOM_PORT_NR** input.

Any further EnOcean function blocks in the program can only be used in conjunction with the **FbThermokonSTC65_RS485_EVC** function block. The function blocks are synchronized using the **typEnocean** variable structure, which is provided as an input on all function blocks in the EnOcean library (*Enocean_05.lib*).

Note: **Function blocks**
The **FbThermokonSTC65_RS485_EVC** function block may only called up once per gateway.

Note: **typEnocean variable structure**
The variable structure should be declared globally to make data exchange between the programs possible.

Note: **Serial interface**
The 750-652 RS-485 module is used as the interface. The **FbThermokonSTC65_RS485_EVC** function block configures the module with the following parameters:

Baud rate:	9600
Data bits:	8
Stop bits:	1
Parity:	Even
Duplex mode:	Half duplex

6.3   Determining the Gateway Station Address

The Thermokon gateway has a 4-byte long station address. Using **FbQueryStationAddress** function block, the station address of the gateway (**dwStationAddress**) can be requested (see Figure 4).

```
0001 PROGRAM QueryStationAddress
0002 (**********************************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Program to query station address of the gateway.
0007 Version:    1.0
0008 Date:       25.03.2013
0009 **********************************************************************)
0010 VAR
0011     QueryStationAddress      : FbQueryStationAddress;
0012     xQuery                   : BOOL;
0013     xTimeout                 : BOOL;
0014     dwStationAddress         : DWORD;
0015 END_VAR
0016
```

```
0001 (*Query Station Address*)
                        QueryStationAddress
                     FbQueryStationAddress
        xQuery─xQuery              dwStationAddress───────────dwStationAddress
     typEnocean─typEnocean ▷            xTimeout───xTimeout
```

Figure 4: Program for requesting the station address of the gateway

6.4   Determining the ID Number

The **FbShow_ID_ByClick** function block (see Figure 5) is used to determine the ID number of the sensor. Each sensor has a unique ID number.
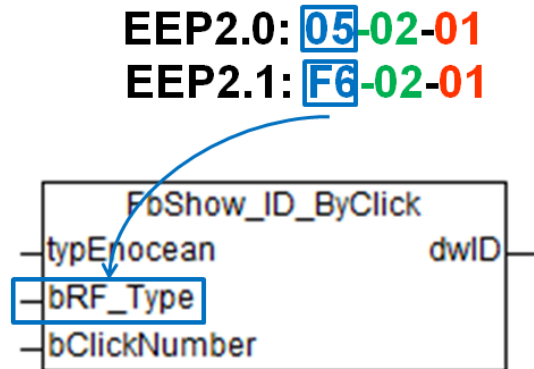

Figure 5: Function block for determining the ID number of a device

A filter can be selected via input of the **bRF_TYPE** input parameter so that only the telegrams of this sensor type will be identified by the function block. The value to be set at the **bRF_TYPE** input can be read from the EEP of the radio sensor to search for (see Figure 5).

There are three sensor types:

1. **bRF_TYPE**= 16#05 or 16#F6 is a sensor that transmits telegrams according to the EEP ORG number 16#05 (RORG number 16#F6).
   Example: Touch sensor with piezoelectric contact (e.g. PTM200)

2. **bRF_TYPE**= 16#06 or 16#D5 is a sensor that transmits telegrams according to the EEP ORG number 16#06 (RORG number 16#D5).
   Example: Window contact with solar power supply

3. **bRF_TYPE**= 16#07 or 16#A5 is a sensor that transmits telegrams according to the EEP ORG number 16#07 (RORG number 16#A5).
   Example: Thermokon SR04 room operating panel

6.4.1 Example: SR04 (Thermokon)

The ID number of an SR04 room operating panel (Thermokon) should be determined (see Figure 6). Because the room operating panel transmits the telegram according to the EEP ORG number **16#07**, the **bRF_TYPE** input is set to "**16#07**".

The **bClick_Number** input is set to "2". The sensor ID is then output with the same ID after receipt of two consecutive telegrams.

For the room operating panel to transmit two telegrams in succession, the learn or occupancy button (if available) must be pressed twice.

Figure 6: Program for determining the ID number of the SR04 room operating panel

6.5   Determining the Suitable EEP Function Block

The names of the function blocks identify the EEP used. There are two different EEP definitions (2.0 and 2.1), but they can be considered synonymous. The WAGO function blocks are marked with the designation from EEP2.1. The value at the **bTYPE** input corresponds to the TYPE number (s.eeFigure 7).
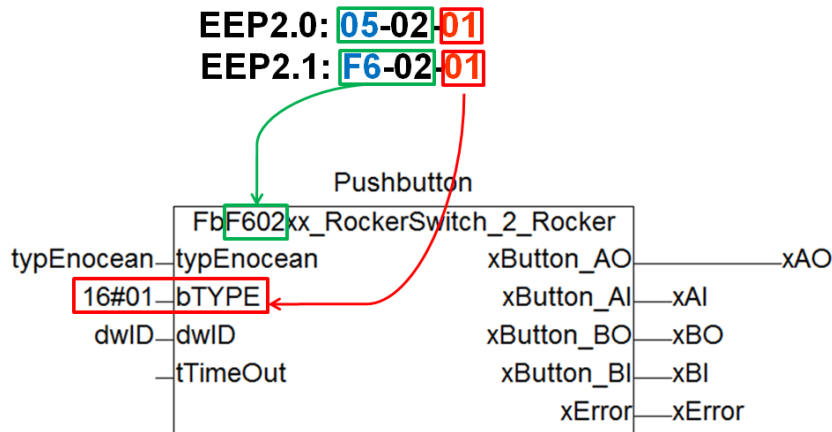

Figure 7: Instance of an EEP function block for a button with F6-02-01

Information   **Determining the EEP of a device**

You can get the EEP of a device from the manufacturer directly. There is a list with frequently used sensors and their EEP in the description of the WAGO *Enocean_05.lib* library.

If the information about the EEP of the device is unknown, the telegram can be received and evaluated in the raw data (see Chapter 6.6.4 on page 20).

NOTE   **Selecting an EEP**

The data will be evaluated incorrectly if the EEP is not selected correctly.

6.6   Receive Telegram

6.6.1   Evaluating the Signal of a Room Operating Panel

```
0001 PROGRAM PRG_RoomOperatingPanel
0002 (***********************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Program to read a room operating panel's telegram with EEP A5-10-01 or 07-10-01
0007
0008 Version:    1.0
0009 Date:       25.03.2013
0010 ***********************************************************)
0011 VAR
0012     RoomOperatingPanel       : FbA510xx_RoomOperatingPanel;
0013     dwID                     : DWORD := 16#00789;
```


Figure 8: Reading the room operating panel

Figure 8 shows the program for reading a Thermokon SR04PST room operating panel. An instance of the **FbA510xx_RoomOperatingPanel** function block is called up. Selection of the function block depends on the communication profile used by the device (e.g. here 07-10-01 or A5-10-01).

The **bTYPE** input denotes the property of the device (TYPE) and can be read from the communication profile. The TYPE number is "01". Therefore, the value "16#01" is entered at the **bTYPE** input.

With the help of the **FbShow_ID_ByClick** function block, the ID number of the room operating panel can be determined. The **dwID** variable must be initialized with the ID number determined or the ID number determined is entered as a constant number at the input of the function block.

6.6.2   Evaluating the Signal of a Touch Sensor

```
0001 PROGRAM PRG_Pushbutton
0002 (*******************************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Program to read a push button's telegram with EEP F6-02-01 or 05-02-01
0007
0008 Version:    1.0
0009 Date:       25.03.2013
0010 *******************************************************************)
0011 VAR
0012    Pushbutton          : FbF602xx_RockerSwitch_2_Rocker;
0013    dwID                : DWORD:=16#00139475;
0014    xAO                 : BOOL;
```

```
0001 (*Read EEP F6-02-01 or 05-02-01*)
                            Pushbutton
                 FbF602xx_RockerSwitch_2_Rocker
typEnocean—typEnocean                xButton_AO————xAO
     16#01—bTYPE                     xButton_AI—xAI
      dwID—dwID                      xButton_BO—xBO
           —tTimeOut                 xButton_BI—xBI
                                         xError—xError
```
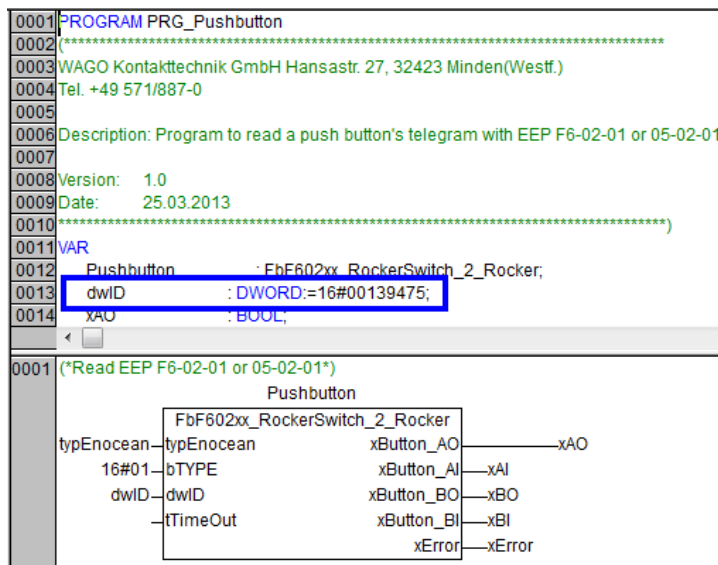
Figure 9: Reading the button signal

The telegram of an EnOcean PTM200 button should be evaluated. The PTM200 button transmits a telegram according to the EEP 05-02-**01** (F6-02-**01**). To evaluate the telegram, an instance of the **FbF602xx_RockerSwitch_2_Rocker** function block is used.

The **bTYPE** input denotes the property of the device (TYPE) and can be read from the communication profile. The TYPE number is "**01**". Therefore, the value "16#01" is entered at the **bTYPE** input.

The output signals (**xButton_AO** to **xButton_BI**) correspond to the four contact grommets and are set to "TRUE" depending on the button pressed.

Channel A   Channel B
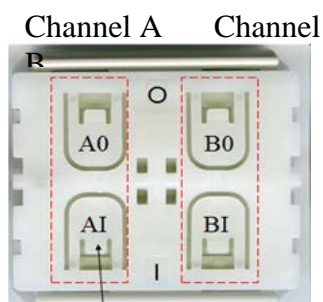
Contact grommet

Figure 10: Assignment of the contact grommets of an EnOcean button

With the help of the **FbShow_ID_ByClick** function block, the ID number of the device can be determined (see Subchapter 6.4 on page 14). The **dwID** variable must be initialized with the ID number determined or the ID number determined is entered as a constant number at the input of the function block.

6.6.3 Evaluating the Signal of a Window Contact

```
0001 PROGRAM PRG_WindowContact
0002 (************************************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Program to read a window contact's telegram with EEP D5-00-01 or 06-00-01
0007
0008 Version:   1.0
0009 Date:      25.03.2013
0010 ************************************************************************)
0011 VAR
0012    WindowContact          : FbD500xx_ContactsAndSwitches;
0013    dwID                   : DWORD:=16#00018E79;
0014    xContact               : BOOL;
```

```
0001 (*Read data from a Themokon STM250 window contact*)
                          WindowContact
                  ┌──────────────────────────────┐
                  │  FbD500xx_ContactsAndSwitches │
typEnocean──────── typEnocean            xContact ├───────── xContact
       16#01────── bTYPE                   xError ├── xError
        dwID────── dwID                           │
                 ─ tTimeOut                        │
                  └──────────────────────────────┘
```

Figure 11: Reading the window contact

The telegram of an EnOcean STM250 window contact (Thermokon) should be evaluated.

The STM250 window contact transmits a telegram according to the EEP 06-00-**01** (D5-00-**01**). To evaluate the telegram, an instance of the **FbD500xx_ContactsAndSwitches** function block is used.

The **bTYPE** input denotes the property of the device (TYPE) and is read from the communication profile. The TYPE number is "**01**". Therefore, the value "16#01" is entered at the **bTYPE** input.

With the help of the **FbShow_ID_ByClick** function block, the ID number of the device can be determined (see Subchapter 6.4 on page 14). The **dwID** variable must be initialized with the ID number determined or the ID number determined is entered as a constant number at the input of the function block.

6.6.4 Receive Raw Data

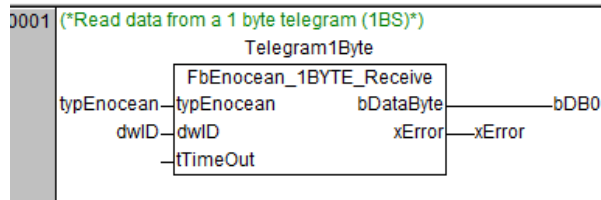If the EEP of the device is unknown, it is also possible to read the raw data of the device.

Figure 12: Reading the 1-byte telegram

Figure 12 shows the program for reading a 1-byte telegram (RPS-/ 1-BS-Telegramm). An instance of the **FbEnocean_1BYTE_Receive** function block is called up.
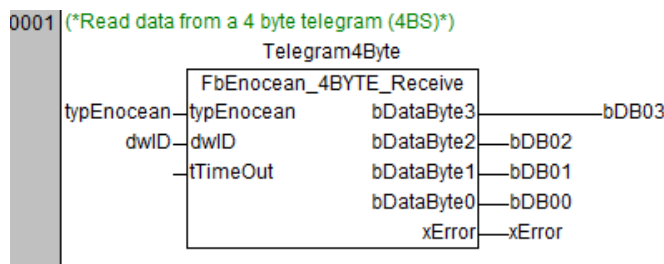

Figure 13: Reading the 4-byte telegram

Figure 13 shows the program for reading a 4-byte telegram (4-BS-Telegramm). An instance of the **FbEnocean_4BYTE_Receive** function block is called up.

6.7 Transmit Telegram

6.7.1 Virtual EnOcean Button in CODESYS

Figure 14 shows the program for transmitting an EnOcean button signal. The **FbEnoceanSendButtonSignal** function block is used for this purpose. The function block transmits a telegram according to EEP F6-02-01.
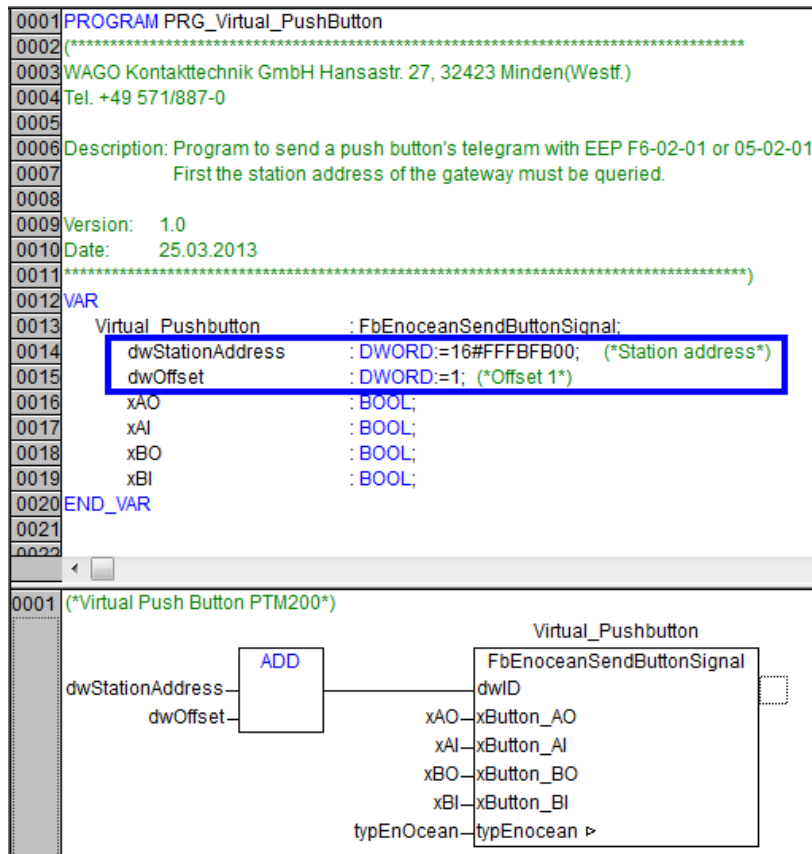

Figure 14: Transmit button signal

The inputs (**xButton_AO** to **xButton_BI**) correspond to the four button signals of a switch. The function block allows simulation of a virtual button in the CODESYS program.

The telegram to transmit requires a unique transmission ID number. The ID number of the telegram is calculated from addition of the station address of the **dwStationAddress** gateway and an offset (**dwOffset**). The value range of the offset goes from 1 to 127. Therefore, there are a total of 127 transmission ID numbers available.

Using **FbQueryStationAddress** function block, the station address of the gateway can be requested (see Subchapter 6.3 on page 13). The **dwStationAddress** variable should be initialized with the requested station address.

6.7.2   Transmit Data Byte

Figure 15 shows the program for transmitting a 4-byte telegram (4-BS-Telegramm). An instance of the **FbEnocean_4BYTE_Send** function block is called up.

```
0001 PROGRAM PRG_Send_4_Byte_Telegram
0002 (*****************************************************************
0003 WAGO Kontakttechnik GmbH Hansastr. 27, 32423 Minden(Westf.)
0004 Tel. +49 571/887-0
0005
0006 Description: Program to send 4-BS-Telegram
0007          First the station address of the gateway must be queried.
0008
0009 Version:    1.0
0010 Date:       25.03.2013
0011 *****************************************************************)
0012 VAR
0013     Send4ByteTelegram          : FbEnocean_4BYTE_Send;
0014        dwStationAddress         : DWORD:=16#FFFBFB00;   (*Station address*)
0015        dwOffset                 : DWORD:=3;  (*Offset 3*)
0016        xUpdate                  : BOOL;
0017        bDataByte3               : BYTE;
0018        bDataByte2               : BYTE;
0019        bDataByte1               : BYTE;
0020        bDatabyte0               : BYTE;
0021        bSendOnDelta             : BYTE;
0022        tMinSendTime             : TIME;
0023 END_VAR
```

```
0001 (*Send 4 byte telegram*)
                                              Send4ByteTelegram
                          ADD                 FbEnocean_4BYTE_Send
     dwStationAddress─                       ─dwID
            dwOffset─                         
                          xUpdate─xUpdate
                       bDataByte3─bDataByte3
                       bDataByte2─bDataByte2
                       bDataByte1─bDataByte1
                       bDatabyte0─bDataByte0
                     bSendOnDelta─bSendOnDelta
                     tMinSendTime─tMinSendTime
                       typEnOcean─typEnocean ▷
```
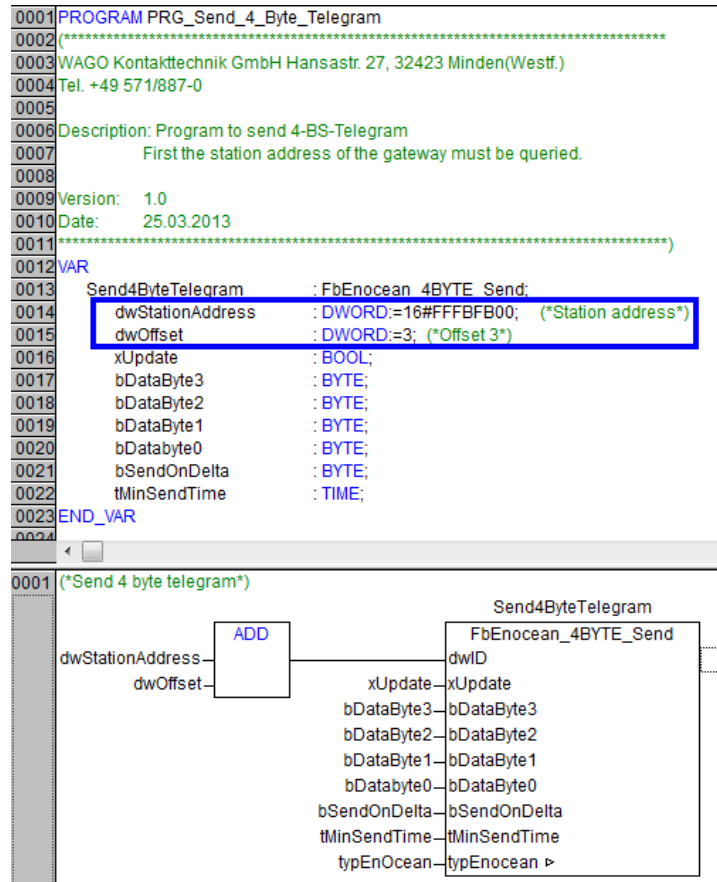
Figure 15: Transmitting the 4-byte telegram

So that the STC-RS485-EVC gateway can transmit the telegram, the telegram to send requires a unique address, i.e. a so-called ID number. The ID number of the telegram is calculated from addition of the station address of the gateway (**dwStationAddress**) and the address offset (**dwOffset**). The value range of the offset goes from 1 to 127. Therefore, there are a total of 127 transmission ID numbers available.

Using **FbQueryStationAddress** function block, the station address of the gateway can be requested (see Subchapter 6.3 on page 13). The **dwStationAddress** variable should be initialized with the requested station address.

6.8 Bidirectional Communication

6.8.1 Bidirectional Function Block

Some devices use an EnOcean profile for bidirectional communication. The WAGO library provides the function blocks for this purpose. The **FbA52001_BatteryPoweredActuator** function block is an example.
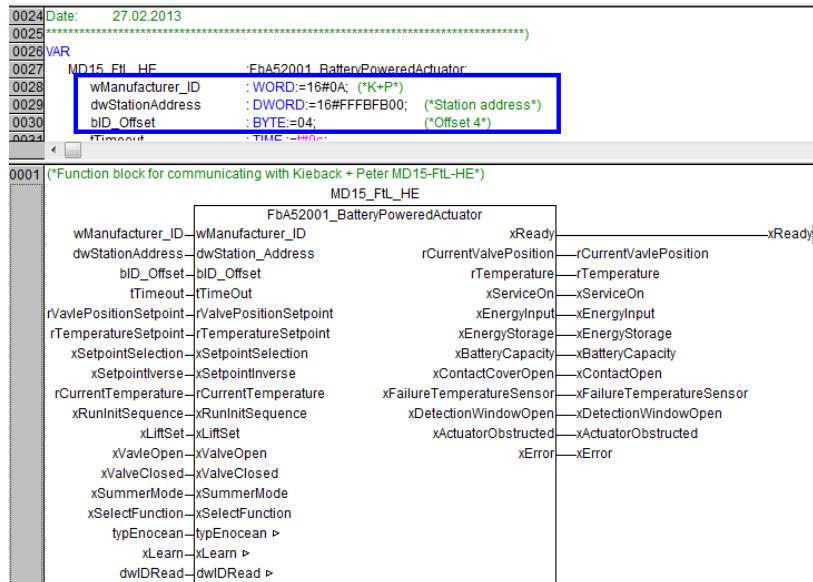

Figure 16: Program for bidirectional communication

Figure 16 shows the program using bidirectional communication with an MD15-FtL-HE small actuator from Kieback+Peter. The small actuator uses EEP 07-20-01 (A5-20-01). For each small actuator to address, an instance of the **FbA52001_BatteryPoweredActuator** function block is required. The data of the small actuator to be addressed is read via this function block and the input values can be transferred to the device.

The function block and the device must be "introduced" to one another as radio communication partner devices at the beginning of commissioning. The block must be set to the learning mode by setting the **xLearn** input (**xLearn** = "TRUE").

Then press the button on the small actuator. The device then transmits a radio telegram that is received by the block. The device ID received is indicated at the **dwIDRead** input and stored. The **xLearn** variable is reset when the block ID has been successfully received.

Using **FbQueryStationAddress** function block, the station address of the gateway can be requested (see Subchapter 6.3 on page 13). The **dwStationAddress** variable should be initialized with the requested station address.

Required Libraries

Table 6: Required libraries

Library	Description
Standard.lib	Standard functions
mod_com.lib	Recognition of the module's position
SerComm.lib	Basic functionality of the serial interface
Serial_Interface_01.lib.	Communication block for the serial module
Enocean_05.lib	EnOcean EEP library

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