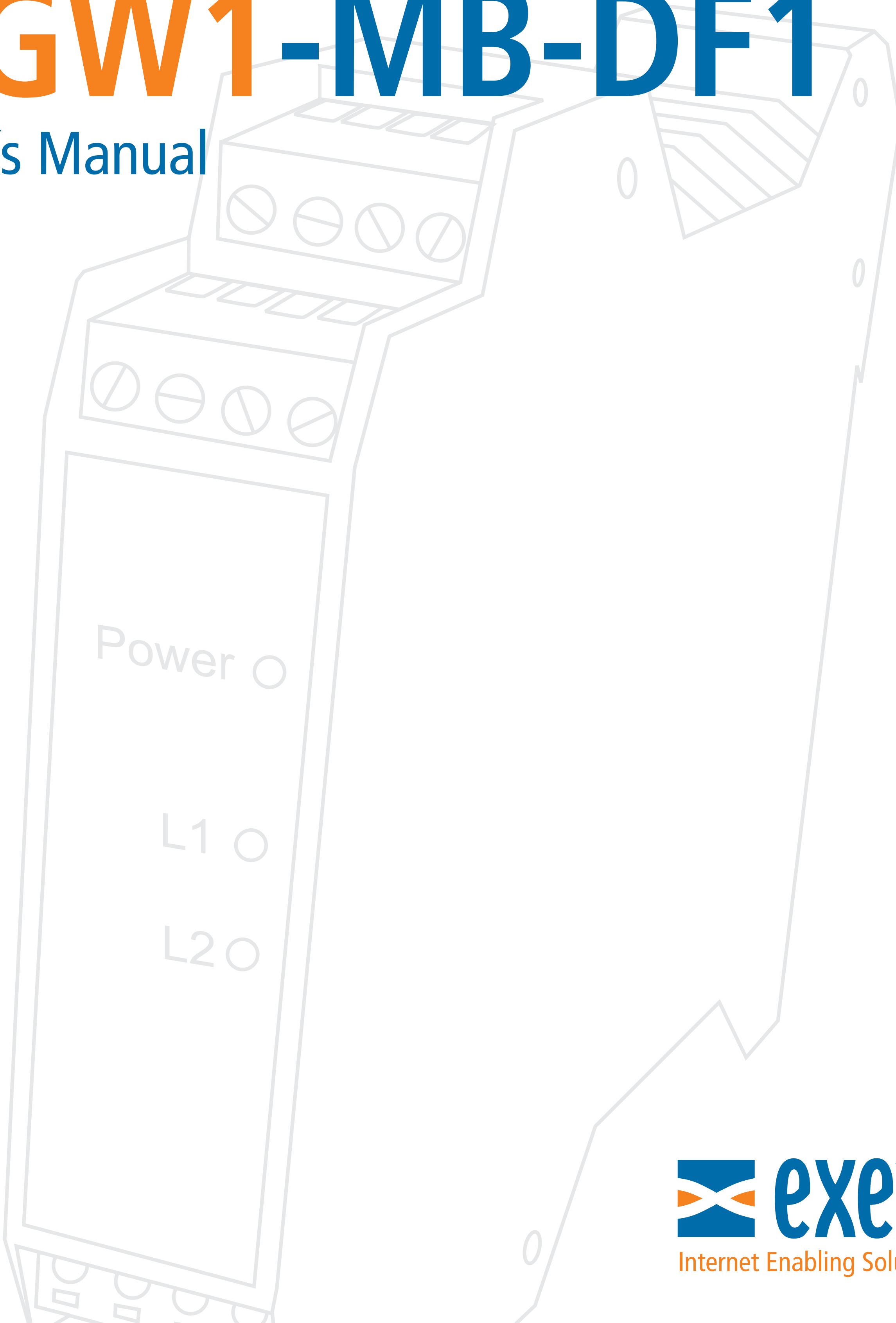
Modbus ASCII / RTU to DF1 Converter

# SGW1-MB-DF1

## User´s Manual

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Internet Enabling Solutions

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# Chapter 1

## Introduction

Thank you for your purchase! SGW1-MB-DF1 is a Modbus ASCII/RTU to DF1 gateway.
SGW1-MB-DF1 lets you gain access to a wide range of industrial DF1-talking devices just by using Modbus, a *de facto* standard in the industrial field.
As a bonus, SGW1-MB-DF1 incorporates the following features:

- An embedded Modbus slave, which provides built-in digital I/O for remote sensing and controlling (four inputs and four outputs).
- A serial text-based console, that allows full configuration of the device.

**Table 1 - Available Models**

| Model | Serial Protocols | | Inputs | Outputs | Serial Ports |
|---|---|---|---|---|---|
| SGW1 - 2044 - MB - DF1 | Modbus ASCII/RTU | DF1 Full Duplex | 4 | 4 | (2) RS-232 |

# Chapter 2

## Getting Started

This chapter shows how to get your new SGW1-MB-DF1 started. It focuses on the main features of this product, that is, Modbus ASCII/RTU to DF1 protocol conversion. For clarity, it is based on an example. Learn how to connect the cables, power up and configure the device in minutes.

### 2.1 Wiring instructions

Power supply and RS-232 ports: These signals are located in the top green connectors. Figure 1 shows the basic wiring. Refer to Appendix A if you need more details.

TIP

**Detach the green connectors before screwing the cables to ease the wiring.**

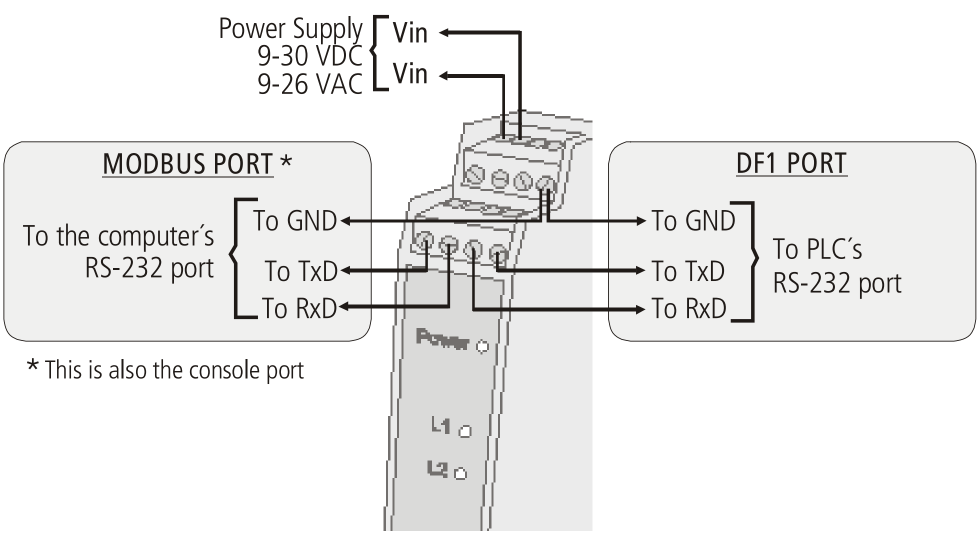


Figure 1 – Wiring instructions

### 2.2 Device configuration

SGW1-MB-DF1 is configured through a serial text-based console. Under regular operation, this console is not used. Indeed, it will be opened only when you start operating the device for the first time and if you eventually need to modify its configuration in the future. Configured values are stored in non-volatile memory, so the device can be powered off without the risk of losing data.

### 2.2.1 Opening the Serial console

The serial console is physically tied to the same port used to process Modbus traffic. Then, you do not need to remove/replace the cables every time you configure the device.

When SGW1-MB-DF1 boots up, it enables a seven-seconds window to open the configuration console. Within this lapse, no Modbus requests will be processed. However, if the user opens the console, it will be kept in that state until the console is explicitly closed. If the seven-seconds window elapses without receiving any request that opens the console, the device will start working in gateway mode (e.g. converting from Modbus ASCII/RTU to DF1).

To configure the device, first open a terminal in your computer (HyperTerminal or alike). Configure the terminal to open the same RS-232 port connected to the SGW1-MB-DF1. Set up the program as follows:

| | |
|---|---|
| Data bits | 8 |
| Parity | None |
| Stop bit | 1 |
| Flow Control | None |
| Baud rate | 9600bps |

Then, power the device on and type CFG <ENTER> within the first seven seconds. You should receive a welcome message on the terminal screen:

**Listing 1 - Welcome message**

```
SGW1-MB-DF1 - Exemys (v1.2):
---------------------------
>
```

Now the device is running in configuration mode. If you cannot see a message as above, check the wiring and terminal configuration.

### 2.2.2 Serial Ports Configuration

You have to configure both RS-232 ports to work with your Modbus master (computer side) and the DF1 device (PLC side). Let's configure the Modbus port first. Assuming baud rate=115200 bps and no parity, type the following commands:

**Listing 2 - Modbus port configuration**

```
SGW1-MB-DF1 - Exemys (v1.2):
---------------------------
>mbbaud:115200
OK, Baud rate:115200

>mbparity:n
OK, Parity:NONE

>
```

Now let's set the DF1 port. An auto detection feature configures the device automatically:

**Listing 3 - DF1 port auto detection**

```
>autodetect
Please wait while detecting configuration...
    Baud rate: 19200
    Parity: NONE

>
```

If no PLC is detected, check the cable that connects SGW1-MB-DF1 to the PLC and retry.
Next, let's set the BCC/CRC (error detection mechanism in DF1 protocol). Note that this parameter must match the one configured on the PLC. Also, we have to specify the Modbus mode, that is, ASCII or RTU:

**Listing 4 - DF1 Error detection and Modbus mode**

```
>error:crc
OK, Error detection mechanism:CRC
>mbmode:r
OK, Mode:RTU

>
```

Now we are done with ports configuration. In the next section we will go on with the tables that tell the device how to perform the translation between both protocols.

### 2.2.3 Configuration of the Translation Tables

In order to address PLC data, SGW1-MB-DF1 maintains some internal Translation Tables between Modbus and DF1 protocols. The tables are applied to internal Files, but not to the Input/Output modules connected to the PLC.

NOTE

**Many newer PLCs (such as FlexLogix and ControlLogix) do not provide (as a factory default) compatibility with the commands requested by the SGW1-MB-DF1. However, they include a mechanism to make themselves downwards compatible with older PLCs and with the SGW1-MB-DF1. Please refer to Appendix C if you are attempting to connect one of this PLCs to the SGW1-MB-DF1.**

Henceforth, a real situation is proposed. It might differ slightly from your actual configuration, though we think of a study case as the best way to get in touch with your new protocol converter.

There is PLC that runs a program. We want to make some data available to one Modbus master by means of the SGW1-MB-DF1. The PLC has four Input/Output boards. These boards have the following I/O capabilities:

| Module | Characteristics | Capacity |
|---|---|---|
| 1 | 16 Digital Inputs | 1 word |
| 2 | 32 Digital Outputs | 2 words |
| 3 | 4 Analog Inputs | 4 words |
| 4 | 32 Digital Outputs | 2 words |

It is required to access not only I/O data, but it is also important to monitor some words, contained in two N Files (File Numbers 7 and 10) and on some read/write bit variables, contained in one B File, whose File Number is 3.

First, we may check that tables are clean at start-up, for example we check the N Files Table:

**Listing 5 – N Files table**

```
>tblview:n

   File   |  Holding
  Number  |  Register
_____________________
 *** Table empty ***
```

As a factory reset, those tables that are configurable will be empty.
Input and outputs modules connected to the PLC do not require any further configuration in the SGW1-MB-DF1. In order to access the modules, the end user will have to issue appropriate Modbus requests, thus the protocol converter will translate them into DF1 commands which can be understood by the PLC.

The mapping between Modbus and DF1 protocol for Input/Output modules is straightforward. It is summarized in the following rules:

- Input modules can be read through Inputs Status or Input Register.
- Output modules can be read through Coil Status or Holding Register.
- Each Holding Register or Input Register is associated to one word (16 bits). Thus, each word contained in a module is assigned to one Modbus location, either Holding Register or Input Register (generically, one "Register" location).
- Each Coil Status or Input Status is associated to one bit. Thus, each bit contained in a module is assigned to one Modbus location, either Coil Status o a Input Status (generically, one "Status" location).
- The multiple coils write command only allows a write to a single coil.
- Modules with less than one word use one complete Modbus "Register".
- Requests to "Register" locations up to address 64 are assumed to be requests for the modules.
- Requests to "Status" locations up to address 1024 are assumed to be requests for the modules.

The modules will be addressed as shown in the following table, according to the rules above.

| Module | Coil Status | Input Status | Holding Register | Input Register |
|---|---|---|---|---|
| 1 | | 10001-10016 | | 30001-30001 |
| 2 | 00001-00032 | | 40001-40002 | |
| 3 | | 10017-10080 | | 30002-30005 |
| 4 | 00033-00064 | | 40003-40004 | |

For example:
- To read output 20 in module 2,  ask for Coil Status 00021.
- To read word 3 in module 3, ask for Input Register 30004

SGW1-MB-DF1 maintains three internal tables:
N table: lets you add and remove N Files. Each element in an N File is 16-bits wide.
B table: lets you add and remove B Files. Each element in a B File is 1-bit wide.
S table: stores the boundaries for the S File, the area where many PLCs store statistics data.

N and B tables are user configurable, but the S table is fixed.

The data required to insert records into the N or B table are

- which table to use (either B or N)
- row number
- File Number (this number will match the one configured on the PLC)

Going on with the example, we insert the remaining information:

**Listing 6 - Insert records in the N table and B table**

```
>tblins:n,0,7                      // File N, File Number 7, in record 0 (N
Table)
Record inserted

>tblins:n,1,10                           // File N, File Number 10, in record
1 (N Table)
Record inserted

>tblins:b,0,3                      // File B, File Number 3, in record 0 (B
Table)
Record inserted
```

Now we check all the tables, by calling the `tblview` command omitting any other parameter.

**Listing 7 – Contents of all the tables**

```
>tblview

N Table
Length: 2

   File   |  Holding
  Number  |  Register
_____________________
    7     | 40192 40447
   10     | 40448 40703

B Table
Length: 1

   File   |    Coil
  Number  |   Status
_____________________
    3     | 01152 05247

S Table
```

```
Length: 1

   File   |    Input
  Number  |   Status
_____________________
    2     | 30192 30448

>
```

Note that Modbus addresses are assigned by the SGW1-MB-DF1 just after inserting records into the tables. This information will have to be provided to the Modbus master to poll the PLC. A request that cannot be translated by the device will cause a translation error. In turn, SGW1-MB-DF1 will report a Modbus exception (if exceptions are enabled).

## 2.3 Ready to go

After filling the tables with the appropriate information, the device is ready to accept polls from a Modbus master. Power off and on the device, wait al least seven seconds (to skip the configuration mode) and poll the PLC as if it had an actual Modbus port. Following the example proposed in this chapter, the Modbus master should be set as:

Databits: 8
Baudrate: 115200
Parity: None
Unit ID: 1
Modbus mode: RTU

Recall that the only Modbus locations available to the master are those assigned by SGW1-MB-DF1. Figure 2 illustrates how Modbus requests are handled by the device.

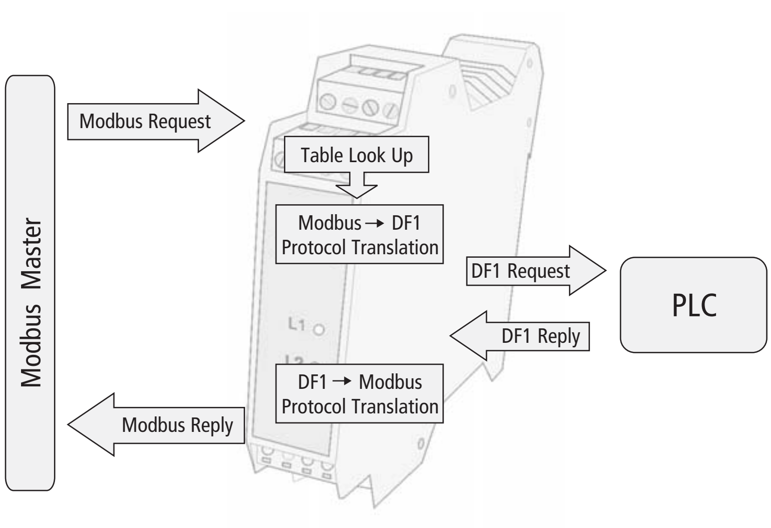


**Figure 2 - Handling incoming Modbus Requests**

# Chapter 3

## Advanced Topics

Chapter 2 outlined some basic configuration. However, for the sake of clarity, many other aspects where not covered there. Those topics are covered in detail in this chapter.

### 3.1 Modbus related commands

The command console includes an online help. By typing `help`, the device sends a clear-text explanation of available Modbus specific commands.

Listing 8 - Modbus related commands

```
>help
Help screen. The following commands are available at the SGW1-MB-DF1:

Modbus related commands
------ ------- --------
>    MBBAUD:n           Baud Rate
        n = {2400,4800,9600,19200,38400,57600,115200}
>    MBPARITY:c Parity
        c = { N(None), E(Even), O(Odd) }
>    MBEXCEP:c          Generate MB Exceptions
        c = { E(Enabled), D(Disabled) }
>    MBMODE:c           Mode
        c = { R(RTU), A(ASCII), D(Auto detection) }
>    MSGTOUT:n          Requests timeout
        0<=n<=9999 [milliseconds]
>    SLVCFG:c,n         Embedded Modbus Slave
        c = { E(Enabled), D(Disabled) }
        0<=n<=255 : Device ID
For next help screen, type HELP2

>
```

**MBBAUD:** this parameter sets the baud rate of the Modbus port.
**MBPARITY**: configures the parity of the Modbus port.
**MBEXCEP**: enables/disables Modbus exceptions. The term *exception* refers to the mechanism defined by the Modbus specification to signal error conditions, such as polling to an invalid address or polling too many locations in memory. Disable this feature if you do not want to receive exceptions upon a failure.
**MBMODE**: selects the Modbus working mode (RTU, or ASCII). You can also try the auto detection feature, that will configure the mode when the first Modbus request arrives.
The format of serial data depends on which mode is configured:

- If you use Modbus ASCII, serial data will be composed of one start bit, seven data bits, one parity bit (optional, if set by configuration) and one stop bit.
- If you use Modbus RTU, serial data will be composed of one start bit, eight data bits, one parity bit (optional, if set by configuration) and one stop bit.

Keep this in mind when you are to configure the Modbus master application.

**MSGTOUT**: This timeout defines the round trip time, measured between the incoming request is received and the appropriate answer is ready to be sent back to the Modbus master. If this timeout is exceeded, an exception may be generated and sent back to the master (if exceptions are enabled).

**SLVCFG**: This parameter enables/disables the embedded Modbus slave, used to control and monitor the built-in inputs and outputs. You may disable the embedded slave if you do not need the built-in I/O. If enabled, the embedded slave receives and processes external requests issued to the configured Unit ID.
chapter.

## 3.2 DF1 related commands

The next help screen (`help2` command) contains configuration commands specific to DF1 protocol:

**Listing 9 - DF1 related commands**

```
>help2
DF1 related commands
--- ------- --------
>    DF1BAUD:n          Baud Rate
        n = {110,300,600,1200,2400,4800,9600,19200,38400,57600,115200}
>    DF1PARITY:c        Parity
        c = { N(None), E(Even) }
>    AUTODETECT Automatically detect baudrate and parity for DF1 link
>    ERROR:c            Error detection mechanism
        c = { B(BCC), C(CRC) }
>    SRCADDR:n          DF1 source address
        0<=n<=255
>    DSTADDR:n          DF1 destination address
        0<=n<=255
>    DSTCFG:c           DF1 destination address option
        c = { F(Fixed), M(Copy Modbus address) }
>    BFILEMODE B files organized in 16 or 32 bits { 16, 32 }
For next help screen, type HELP3. For previous help screen, type HELP

>
```

- **DF1BAUD** and **DF1PARITY**: It is possible to set these parameters manually, that is, without detecting the values by means of the AUTODETECT command. For example these fields could be filled by hand if you want to set the serial parameters before the PLC is actually connected.

- **AUTODETECT:** Auto detection attempts to detect the proper serial link parameters, by sending iterative commands to the PLC.

- **ERROR**: Two methods are provided by the DF1 specification to detect frame errors, BCC and CRC. BCC is a one-octet field appended to a DF1 frame. It contains a checksum of many bytes contained in the message. By the other hand, the CRC, which stands for Cyclic Redundancy

Check and is two-octets long, is a more robust method in the sense that it will detect more errors than BCC, though it requires more computing time. This setting must be coherent with that configured in the PLC: if the PLC is set to BCC you have to set SGW1-MB-DF1 to use BCC and vice versa.

- **SRCADDR**: DF1 frames define source (SRC) and destination (DST) addresses, corresponding to the stations that want to exchange data. While these parameters seem to be important, most implementations do not take care of its values. This is because DF1 is commonly used as a point to point protocol, where only two stations are connected to the wire. As a consequence, addresses are not a matter. However, there are two associated protocols related to DF1, called Data Highway (DH) and Data Highway + (DH+), which provide communication paths among many stations. In these cases, addresses are a must. This field, as well as the one described below, provide compatibility for those protocols, when interfacing the SGW1-MB-DF1 with a DH/DH+ network, using a special adapter.

- **DSTADDR**: This command defines the destination address to be used when issuing DF1 requests. You can choose to use a fixed address, or copy the same address received at the Modbus side. Again, if running legacy DF1, this field and the one described above do not need configuration.

- **DSTCFG**: This parameter is closely related to the DSTADDR command. It allows to use either the fixed destination address (set by configuration with DSTADDR) or copy the incoming Modbus address (so called Unit ID).

- **BFILEMODE:** Some new AB PLCs organize "B" files in 32 bits when they talk the DF1 protocol. So, you can configure the converter to work with 16 bits (for old PLCs) or 32 bits (for news PLCs).

## 3.3 Tables related commands

In this section, some basic aspects on Modbus and DF1 protocols are outlined.
Modbus data are classified into four types. These areas are known as:

- Input Registers
- Holding Registers
- Input Status
- Coil Status

Input Registers and Holding Registers are 16-bit words, while Input Status and Coils Status refer to discrete 1-bit data. By the other hand, Input Registers and Input Status are read-only locations, used to read input data such as digital inputs and statistics. Holding Registers and Coils Status areas may be both read and written.

PLCs compatible with DF1 protocol usually map addressable data into Files and Elements. A group of data with similar characteristics is called a File and each datum within a File is an Element. Files are organized into File Types, according to their different purposes. For example, N

Files are used to store 16-bit integers and B Files store bit variables. Each File is associated to a unique File Number.

As mentioned in Chapter 2, SGW1-MB-DF1 maintains three internal tables for the mapping between Modbus and DF1 protocol. These tables are 1: Input/Output, 2: N Files, 3: B Files and 4: S File.

1. **N Files**: This table provides the capability to map N Files, which store 16-bit program variables. Up to thirty two N Files will be allowed, thus covering a wide range of typical situations. Each Element in the File is mapped into Holding Registers, allowing both reads and writes. The only entry to know before inserting an N File into the table is its File Number. (Usually File Number 7 is associated with a default N File, though other N Files could be configured using the application software provided with your PLC).

2. **B Files**: This table stores the Bit File, used to keep 1 bit variables. Up to two B Files can be added to the table. This might seem an scarce resource, but actually it is not. Have in mind that each 1-bit location is mapped to a different Modbus Coil Status, thus consuming the addressing space very quickly. Also consider that these two B Files lets you map 8192 individual bits, providing an adequate space for most applications. Please pay attention to command BFILEMODE when reading B Files.

3. **S File**: This is the only fixed (non-configurable) table. The mapping (Input Registers 30192-30447) provides reads of internal statistics.

NOTE

In order to work accurately, I/O expansion boards and other Files in general have to be configured with the application software provided by the PLC vendor. Otherwise, the Files will be unavailable to the SGW1-MB-DF1, which will return Modbus exceptions (if enabled) upon unsolved requests. Contact you dealer for specific information about your PLC and configuration.

Many newer PLCs (such as FlexLogix and ControlLogix) do not provide (as a factory default) compatibility with the type of request issued by the SGW1-MB-DF1. However, they incorporate a mechanism to make themselves downwards-compatible with older PLCs and with the SGW1-MB-DF1. Please refer to Appendix C if you are attempting to connect one of these PLCs.

The next help screen (`help3` command) contains configuration commands specific to translation tables:

**Listing 10 - Tables related commands**

```
>help3
Tables related commands
------ ------- --------
>    TBLRST              Reset all tables to factory defaults
>    TBLVIEW:F           View the contents of a Translation Table
>    TBLDEL: F,P         Delete one row from a Translation Table
>    TBLINS: F,P,N       Insert one row into a Translation Table
          ========================================
         |Parameter|      Legal values           |
         |========================================|
```

```
        |    F    |    N    |    B    |    S    |
        |=======================================|
        |    P    | 0..K1+1 | 0..K2+1 |   not   |
        |=============================| allowed |
        |         |  DF1    |  DF1    |(S table |
        |    N    |  File   |  File   |is fixed)|
        |         |  Number |  Number |         |
        |=======================================|
        K1 is the last occupied position in the N table;        0<=K1<=30
        K2 is the last occupied position in the B table;        K2=0
For next help screen, type HELP4. For previous help screen, type HELP2

>
```

Note that this help screen is displayed as a chart. It contains details about how to perform insertions and deletions. It also shows how to view and reset the contents of the tables.

- **TBLRST**: This command resets the tables to factory defaults. Note that the S table will remain unchanged, because it is fixed (not user configurable).

- **TBLVIEW**: This one shows the contents of a table. If no parameter is appended, it shows the contents of the four tables.

- **TBLDEL**: Deletes a record in a table.

- **TBLINS**: Inserts a row into a table. You can insert a record into an intermediate position by selecting the appropriate row. After insertion, rows below the insertion point will be shifted downwards.

Modbus address boundaries are assigned automatically by the device. For example, if you insert a record into the first position of the N Table, the first Element is mapped to Holding Register 40192, the second Element is mapped to Holding Register 40193 and so on. Thus, you will have to configure your Modbus master to make polls within those boundaries in order to obtain valid answers.

## 3.4 General commands

The next help screen (`help4` command) contains general configuration not covered in the previous screens:

**Listing 11 - General commands**

```
>help4
General commands
-------- --------
>    FACTRESET          Restores factory defaults
>    LIST               Show configuration values
>    HELP               Display the help screen
>    END                Finish configuration
End of help screen. For previous help screen, type HELP3

>
```

**FACTRESET**: Resets the device to factory values (recovers default configuration, cleans the tables).

**LIST**: This command displays currently set parameters, as shown below:

**Listing 12- The list command**

```
>list

Baud rate:                      115200
Parity:                         NONE
Modbus exceptions:              ENABLED
Mode:                           RTU
Embedded Modbus Slave:          ENABLED,ID = 240

DF1 related commands
--- ------- --------
Baud rate:                      19200
Parity:                         NONE
Message Timeout:                1000 [milliseconds]
Source address (SRC):           0
Destination address (DST):      1
Destination address option:     Use fixed address
Error detection mechanism:      CRC
B files bit organization:       16
>
```

- **HELP**: Lists the help screens.
- **END**: Finishes configuration. Stores data in non-volatile memory and closes the console.

Chapter 4

# The Embedded Modbus Slave

This chapter explains how to take advantage of the embedded Modbus slave. Remote inputs/outputs are made visible to the user through this Modbus service.

## 4.1 Enabling the slave

Refer to SLVCFG command in section 3.1 to enable the slave.

## 4.2 Monitoring and controlling built-in digital inputs and outputs

Input and output pins are located in the bottom connectors of the SGW1-MB-DF1 case.

The four digital inputs are mapped to Input Status locations, as shown in the following table:

| | | | | |
|---|---|---|---|---|
| Pin Number | 9 | 10 | 11 | 12 |
| Digital Input | I0 | I1 | I2 | I3 |
| Input Status | 10001 | 10002 | 10003 | 10004 |

Recall that Input Status locations are read-only variables. After you issue a read input command, the pins are read and the measure is reported through the answer.

The four digital outputs are mapped to Coil Status locations, as shown in the following table:

| | | | | |
|---|---|---|---|---|
| Pin Number | 13 | 14 | 15 | 16 |
| Digital Output | O0 | O1 | O2 | O3 |
| Coil Status | 00001 | 00002 | 00003 | 00004 |

Coil Status locations are read-write variables. Thus, both reads and writes are allowed for the I/O pins.

# Appendix A

## A.Cabling

### A.1. Power

Figure 3 shows the power input connection, which is located in the **Vin** terminals.
SGW1-MB-DF1 powering has no polarity and accepts an input voltage range of 9 to 30 VDC and 9 to 26 VAC.

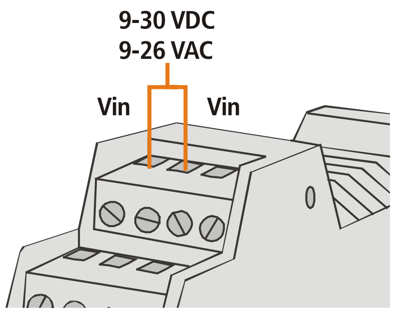


Figure 3 - Power Input Connection Scheme

### A.2. Ground

The GND pin (pin number 4) is the digital ground signal used to provide grounding reference to the digital I/Os and both RS-232 ports.

### A.3. Digital Inputs

Digital inputs are located at pins 9-12. They are terminated with current-sinking transistors. Inputs are active when a voltage in the range 3.5-28 Vdc is applied to the pins. This voltage may be provided by two different ways, depending on the external field device:

- **Case A**: Voltage is self-provided by the external device, that works as a current-sourcing node. (See Figure 4)
- **Case B:** Voltage is not provided by the device (dry contact). An external voltage must be applied. (See Figure 5)

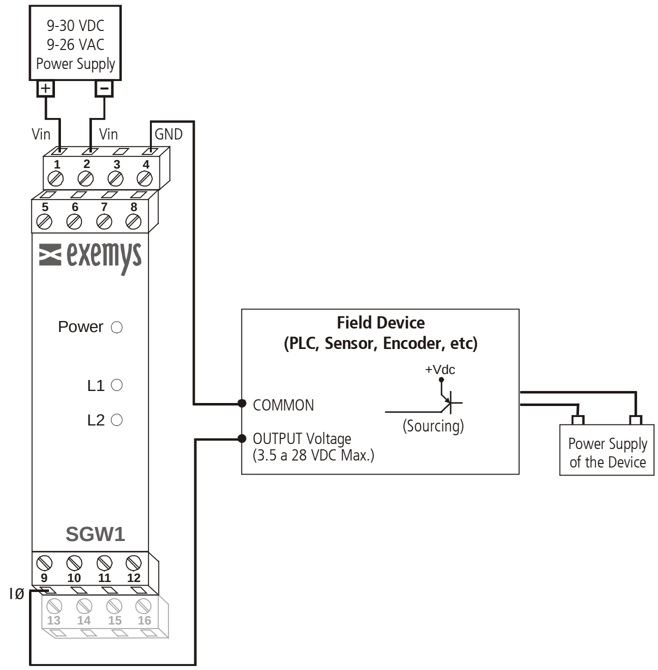


Figure 4 - Digital Input connected to an external device with an independent power supply

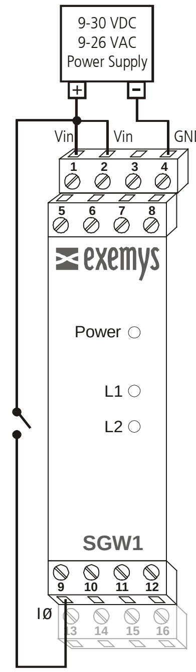


Figure 5 - Digital input connected to a dry contact

Table 2 - Digital Inputs - Technical Specifications

| Digital Inputs | |
|---|---|
| Inputs Type | *Sinking*. Allow dry contacts and current sourcing devices |
| Operating Voltage Range | 3.5 - 28 Vdc |
| Input Current | 1 - 11 mA |

## A.4. Digital Outputs

This device provides four digital outputs located at pins 13-16. Digital outputs are Open Collector. This means that, when active, outputs are electrically tied to GND. Any load connected to an output should be powered in the range 3 - 45 Vdc .

When connecting an output to an external load, two situations may occur. These situations are covered below.

- **Case A:** The external load and the Exemys device use different power supplies. (See Figure 6)
- **Case B:** The external load and the Exemys device share the same power supply. (See Figure 7)

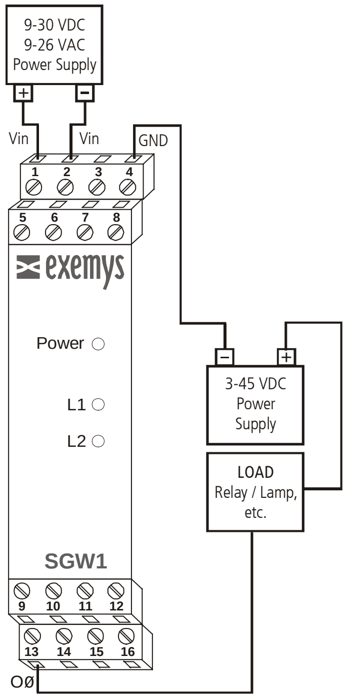


Figure 6 - The load and the Exemys device using two different power supplies

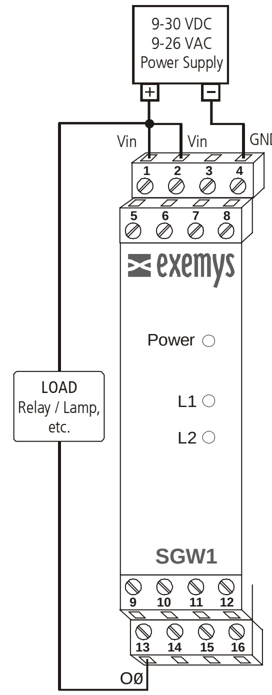


Figure 7 - The load and the Exemys device share the power supply

Table 3 – Digital Outputs – Technical Specifications

| Digital Outputs | |
|---|---|
| Output Type | Open Collector. Current Sinking |
| Maximum Load Voltage | 3 - 45 Vdc Max. |
| Current | 130mA Max. Per output |

## A.5. RS-232 Ports

This product provides two RS-232 ports. The first one is used to connect the device to the computer (running Modbus ASCII/RTU protocol). This port is also tied to the command-line console. The second port provides DF1 connectivity, so it is always connected to the PLC.

### A.5.1. Modbus/console port

Connect your PC comport as depicted in the following figure. Only TX, RX and GND signals are provided (do not configure any kind of flow control in the application).

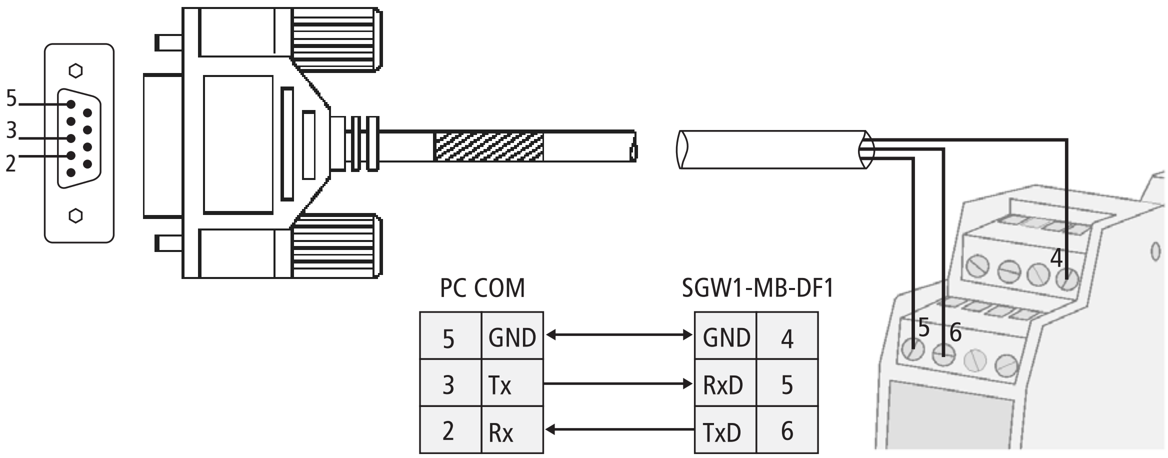


**Figure 8 - Connecting the computer to the SGW1-MB-DF1**

### A.5.2. DF1 port

Connect the PLC to the DF1 port as depicted in the following figures. Only TX, RX and GND signals are provided (do not configure any kind of flow control in the PLC).

Since you may connect this device to different Programmable Logic Controllers, we provide two examples that illustrate the wiring diagram for this device and two commercial PLCs.

**Micrologix 1000:** Connect the Micrologix 1000 to the SGW1-MB-DF1 as shown in Figure 9

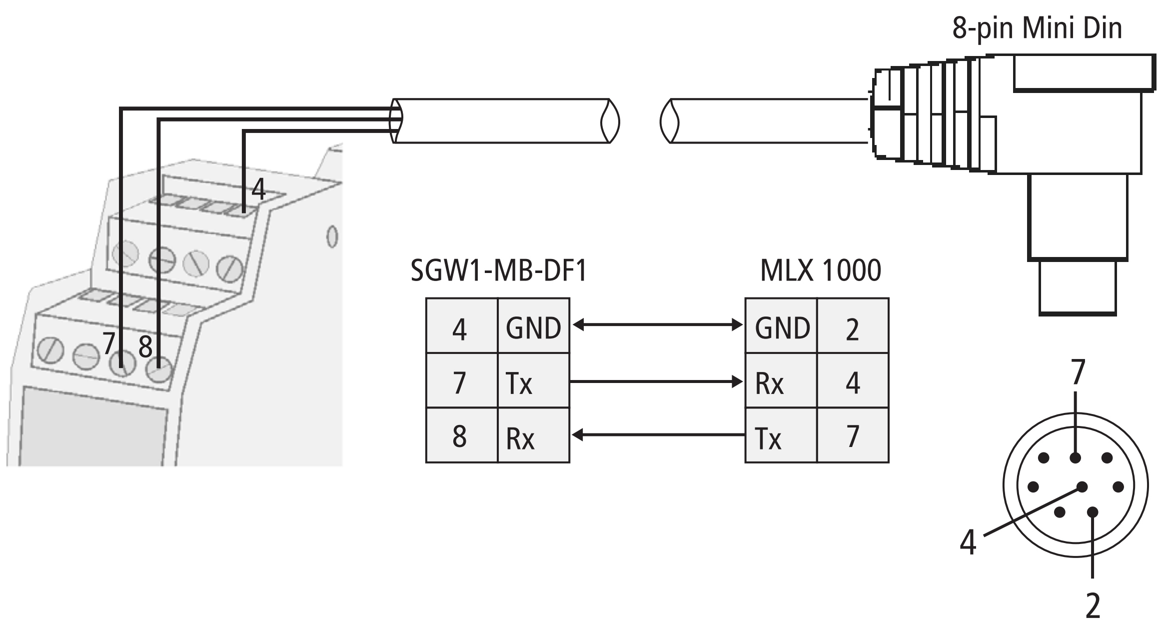


**Figure 9 - Connecting a Micrologix 1000 processor to the SGW1-MB-DF1**

**SLC 500:** Connect the SLC 500 to the SGW1-MB-DF1 as shown in Figure 10

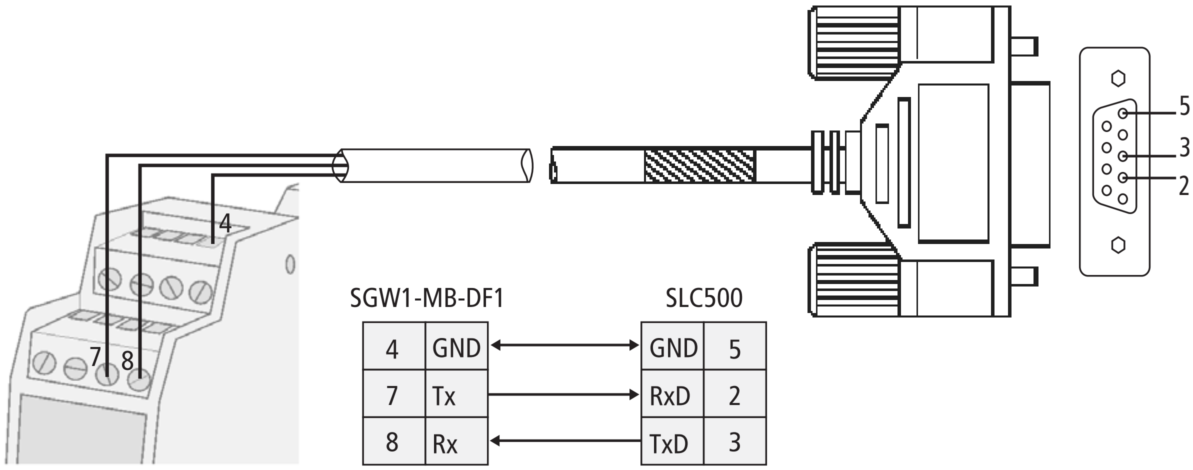


**Figure 10 - Connecting an SLC 500 processor to the SGW1-MB-DF1**

# Appendix B

## B.Monitoring the device through the built-in LEDs

The frontal LEDs provide status information about the device. The meaning of the blinking is provided in the following table.

Table 4 - Meaning of the LEDs blinking

| LED | Meaning |
|---|---|
| Green | Modbus activity. |
| Yellow | DF1 activity |

# Appendix C

## C.Configuring FlexLogix and ControlLogix PLCs

Time ago, Allen Bradley came out with some modifications about the way that newer PLCs exchange data. In the new approach, the PLC defines tags to map data, rather than Files. At the moment of this publication, those PLCs belong to the FlexLogix and ControlLogix families. The new commands are not compatible with SGW1-MB-DF1, yet. However, AB provides downwards-compatibility with the old command set.

SGW1-MB-DF1 only uses two DF1 commands from the original DF1 command set. These commands are:

- *Protected typed logical read with three address fields*
- *Protected typed logical write with three address fields*

Here we provide some basic information to activate the downward compatibility feature, by configuring the PLC using RSLogix 5000.

To map an address:

1. In RSLogix 5000 software, open the project file for the controller whose data you want to access
2. From the Logic menu, select Map PLC/SLC Messages
3. The screen shown will be used to provide the actual mapping between an already defined tag and the File Number you choose to make public to SGW1-MB-DF1. Complete the information required as an SLC mapping. (Choose an appropriate File Number). The tags must be controller-scoped (global).
4. Click OK

NOTE

**If you want to map many data into one File, you can define a tag as an array.**