



# DigiRail-4C

## Digital Counter Input Module

# COMMUNICATION MANUAL

## INTRODUCTION

The **DigiRail-4C** is provided with RS485 two wire serial communication, operating as slave in the Modbus RTU protocol. The entire equipment configuration, as well as reading of the input data, is performed through serial communication.

This manual provides the information necessary for reading the data from the input channels without using the software **DigiConfig**. In order to assure the correct configuration of DigiRail, always use the DigiConfig software. After being configured, the data of its inputs and/or outputs can be accessed by any other software having Modbus RTU communication capacity.

For further details regarding the implementation of a network of devices please refer to the document *Basic Concepts of RS485 and RS422*, available on the CD-ROM which comes together with the product

## MODBUS ADDRESS ASSIGNMENT SYSTEMATICS

The **DigiRail** equipment do not have keys for determination of the Modbus communication address. This must be determined by using the communication in the Modbus protocol itself. This will require that the address of the device to be configured is known, this being possible by two different means:

- If the equipment is a new one, it will show the configuration as set by the factory: Address=247, Baud rate=1200, Parity Even, 1 Stop Bit.
- If the equipment has already been used and you do not know its address and/or other communication parameters, press the RCom button on your front panel. It will enter the diagnostics mode during 1 minute, assuming the following communication parameters: Address=246, Baud rate=1200, parity even, 1 stop bit.

The **DigiConfig** software configurator is provided with a function of searching the network for temporary devices, exactly the devices in the previous conditions. Once having been localized, the address and the other communication parameters of the device can be changed according to the necessity of the application.

The communication parameters in the two previous conditions are not very common in Modbus networks, and they may probably cause no conflicts with other equipment of the network. Obviously only one **DigiRail** in the network can be in each of the previous conditions so that the communication with the configurator **DigiConfig** is possible. If several new **DigiRail** are to be included in a network, they must be inserted individually. Only after changing the communication parameters for the definitive values, the next new **DigiRail** can be inserted. In an already existing network, only one **DigiRail** at a time can be set in diagnostics mode in order to be detected by the **DigiConfig**.

It is important to emphasize that the **DigiConfig** software acts as a master in the Modbus network. Its utilization requires that the original master of the network (SCADA software, for instance) be disconnected during its use. For further details please refer to the on-line Help of the **DigiConfig**.

## MODBUS COMMANDS

The Modbus RTU commands (functions) listed below are implemented. For further information with respect to each one of these commands and the Modbus protocol in general, please access the website:

<http://www.modbus.org>

### READ COILS – 01H

This command can be used for reading the current state of one or several digital inputs, according to the table below.

| Address | Description                            |
|---------|--|
| 0       | State of digital input 1 (0=off; 1=on) |
| 1       | State of digital input 2 (0=off; 1=on) |
| 2       | State of digital input 3 (0=off; 1=on) |
| 3       | State of digital input 4 (0=off; 1=on) |

The specified *addresses* correspond to the low level physical addresses, where zero (0) corresponds to the address of PLC 00001.

The response of this command will inform the state of each requested input with one bit only. Thus the state of the first requested input comes at bit 0 (less significant bit), the state of the second at bit 1 and so on.

## **READ DISCRETE INPUTS - 02H**

This command can be used for reading the current state of one or several digital inputs, according to the table below.

| Address | Description                            |
|---------|--|
| 0       | State of digital input 1 (0=off; 1=on) |
| 1       | State of digital input 2 (0=off; 1=on) |
| 2       | State of digital input 3 (0=off; 1=on) |
| 3       | State of digital input 4 (0=off; 1=on) |

The specified *addresses* correspond to the low level physical addresses, where zero (0) corresponds to the address of PLC 10001.

The response of this command will inform the state of each requested input with one bit only. Thus the state of the first requested input comes at bit 0 (less significant bit), the state of the second at bit 1 and so on.

## **READ HOLDING REGISTERS – 03H**

This command can be used for reading one or several holding registers, according to the table in the chapter apart.

## **WRITE SINGLE REGISTER – 06H**

This command can be used for writing in a holding register, according to the table in the chapter apart.

## **TABLE OF HOLDING REGISTERS**

The specified *addresses* correspond to the low level physical addresses, where zero (0) corresponds to the address of PLC 40001. The columns *minimum* and *maximum* contain the range of values valid for each parameter. The column *R/W* indicates if the parameter is for writing and reading (R/W) or for reading (R) only.

| Address | Description   | SuperView Mnemonic | Minimum | Maximum | R/W |
|---------|---|--------------------|---------|---------|-----|
| 0       | Series number (word high)   | -                  | 0       | 65535   | R   |
| 1       | Series number (word low)  | -                  | 0       | 65535   | R   |
| 2       | Baud-rate   | -                  | 0       | 7       | R/W |
| 3       | Modbus Address  | -                  | 1       | 247     | R/W |
| 4       | Parity  | -                  | 0       | 2       | R/W |
| 5       | Firmware version  | -                  | 0       | 999     | R   |
| 6       | Diagnostic state timer (in tenths of seconds)   | -                  | 0       | 600     | R/W |
| 7       | State of the digital inputs, where bit 0 represents input 1, bit 1 represents input 2 (0=off; 1=on), etc. | -                  | 0       | 15      | R   |
| 8       | State of digital input 1 (0=off; 1=on)  | In1St              | 0       | 1       | R   |
| 9       | State of digital input 2 (0=off; 1=on)  | In2St              | 0       | 1       | R   |
| 10      | State of digital input 3 (0=off; 1=on)  | In3St              | 0       | 1       | R   |
| 11      | State of digital input 4 (0=off; 1=on)  | In4St              | 0       | 1       | R   |
| 12      | Debounce of the digital input 1 (in ms)   | In1DBounc          | 0       | 10000   | R/W |
| 13      | Debounce of the digital input 2 (in ms)   | In2DBounc          | 0       | 10000   | R/W |
| 14      | Debounce of the digital input 3 (in ms)   | In3DBounc          | 0       | 10000   | R/W |
| 15      | Debounce of the digital input 4 (in ms)   | In4DBounc          | 0       | 10000   | R/W |
| 16      | Configuration of the digital inputs   | InCfg              | 0       | 1       | R/W |
| 17      | Preset, inhibiting and selecting the margin of the counters   | InPreset           | 0       | 4095    | R/W |
| 18      | Value of the input 1 counts - most significant word   | Count1H            | 0       | 0       | R   |
| 19      | Value of the input 1 counts - least significant word  | Count1L            | 0       | 0       | R   |
| 20      | Value of the input 2 counts - most significant word   | Count2H            | 0       | 65535   | R   |
| 21      | Value of the input 2 counts - least significant word  | Count2L            | 0       | 65535   | R   |
| 22      | Value of the input 3 counts - most significant word   | Count3H            | 0       | 65535   | R   |
| 23      | Value of the input 3 counts - least significant word  | Count3L            | 0       | 65535   | R   |
| 24      | Value of the input 4 counts - most significant word   | Count4H            | 0       | 65535   | R   |
| 25      | Value of the input 4 counts - least significant word  | Count4L            | 0       | 65535   | R   |
| 26      | Preset value of the input 1 counts - most significant word  | Preset1H           | 0       | 65535   | R/W |

| Address | Description  | SuperView Mnemonic | Minimum | Maximum | R/W |
|---------|--|--------------------|---------|---------|-----|
| 27      | Preset value of the input 1 counts - least significant word              | Preset1L           | 0       | 65535   | R/W |
| 28      | Preset value of the input 2 counts - most significant word               | Preset2H           | 0       | 65535   | R/W |
| 29      | Preset value of the input 2 counts - least significant word              | Preset2L           | 0       | 65535   | R/W |
| 30      | Preset value of the input 3 counts - most significant word               | Preset3H           | 0       | 65535   | R/W |
| 31      | Preset value of the input 3 counts - least significant word              | Preset3L           | 0       | 65535   | R/W |
| 32      | Preset value of the input 4 counts - most significant word               | Preset4H           | 0       | 65535   | R/W |
| 33      | Preset value of the input 4 counts - least significant word              | Preset4L           | 0       | 65535   | R/W |
| 34      | Device tag - characters 1 and 2  | -                  | 0       | 65535   | R/W |
| 35      | Device tag - characters 3 and 4  | -                  | 0       | 65535   | R/W |
| 36      | Device tag - characters 5 and 6  | -                  | 0       | 65535   | R/W |
| 37      | Device tag - characters 7 and 8  | -                  | 0       | 65535   | R/W |
| 38      | Device tag - characters 9 and 10   | -                  | 0       | 65535   | R/W |
| 39      | Tag of digital input 1 - characters 1 and 2                              | -                  | 0       | 65535   | R/W |
| 40      | Tag of digital input 1 - characters 3 and 4                              | -                  | 0       | 65535   | R/W |
| 41      | Tag of digital input 1 - characters 5 and 6                              | -                  | 0       | 65535   | R/W |
| 42      | Tag of digital input 1 - characters 7 and 8                              | -                  | 0       | 65535   | R/W |
| 43      | Tag of digital input 1 - characters 9 and 10                             | -                  | 0       | 65535   | R/W |
| 44      | Tag of digital input 2 - characters 1 and 2                              | -                  | 0       | 65535   | R/W |
| 45      | Tag of digital input 2 - characters 3 and 4                              | -                  | 0       | 65535   | R/W |
| 46      | Tag of digital input 2 - characters 5 and 6                              | -                  | 0       | 65535   | R/W |
| 47      | Tag of digital input 2 - characters 7 and 8                              | -                  | 0       | 65535   | R/W |
| 48      | Tag of digital input 2 - characters 9 and 10                             | -                  | 0       | 65535   | R/W |
| 49      | Tag of digital input 3 - characters 1 and 2                              | -                  | 0       | 65535   | R/W |
| 50      | Tag of digital input 3 - characters 3 and 4                              | -                  | 0       | 65535   | R/W |
| 51      | Tag of digital input 3 - characters 5 and 6                              | -                  | 0       | 65535   | R/W |
| 52      | Tag of digital input 3 - characters 7 and 8                              | -                  | 0       | 65535   | R/W |
| 53      | Tag of digital input 3 - characters 9 and 10                             | -                  | 0       | 65535   | R/W |
| 54      | Tag of digital input 4 - characters 1 and 2                              | -                  | 0       | 65535   | R/W |
| 55      | Tag of digital input 4 - characters 3 and 4                              | -                  | 0       | 65535   | R/W |
| 56      | Tag of digital input 4 - characters 5 and 6                              | -                  | 0       | 65535   | R/W |
| 57      | Tag of digital input 4 - characters 7 and 8                              | -                  | 0       | 65535   | R/W |
| 58      | Tag of digital input 4 - characters 9 and 10                             | -                  | 0       | 65535   | R/W |
| 59      | Pulse counting interval time (in 0.1 seconds)                            | -                  | 0       | 36000   | R/W |
| 60      | Peak pulse counting interval time (in 0.1 seconds)                       | -                  | 0       | 36000   | R/W |
| 61      | Reserved   | -                  | 0       | 0       | R   |
| 62      | DigiRail model   | -                  | 0       | 4       | R   |
| 63      | Counted pulses in the last interval for input 1 - most significant word  | PulseRate1H        | 0       | 65535   | R   |
| 64      | Counted pulses in the last interval for input 1 - least significant word | PulseRate1L        | 0       | 65535   | R   |
| 65      | Counted pulses in the last interval for input 2 - most significant word  | PulseRate2H        | 0       | 65535   | R   |
| 66      | Counted pulses in the last interval for input 2 - least significant word | PulseRate2L        | 0       | 65535   | R   |
| 67      | Counted pulses in the last interval for input 3 - most significant word  | PulseRate3H        | 0       | 65535   | R   |
| 68      | Counted pulses in the last interval for input 3 - least significant word | PulseRate3L        | 0       | 65535   | R   |
| 69      | Counted pulses in the last interval for input 4 - most significant word  | PulseRate4H        | 0       | 65535   | R   |

| Address | Description   | SuperView Mnemonic | Minimum | Maximum | R/W |
|---------|---|--------------------|---------|---------|-----|
| 70      | Counted pulses in the last interval for input 4 - least significant word        | PulseRate4L        | 0       | 65535   | R   |
| 71      | Maximum of pulses counted on time interval for input 1 - most significant word  | PeakPulse1H        | 0       | 65535   | R   |
| 72      | Maximum of pulses counted on time interval for input 1 - least significant word | PeakPulse1L        | 0       | 65535   | R   |
| 73      | Maximum of pulses counted on time interval for input 2 - most significant word  | PeakPulse2H        | 0       | 65535   | R   |
| 74      | Maximum of pulses counted on time interval for input 2 - least significant word | PeakPulse2L        | 0       | 65535   | R   |
| 75      | Maximum of pulses counted on time interval for input 3 - most significant word  | PeakPulse3H        | 0       | 65535   | R   |
| 76      | Maximum of pulses counted on time interval for input 3 - least significant word | PeakPulse3L        | 0       | 65535   | R   |
| 77      | Maximum of pulses counted on time interval for input 4 - most significant word  | PeakPulse4H        | 0       | 65535   | R   |
| 78      | Maximum of pulses counted on time interval for input 4 - least significant word | PeakPulse4L        | 0       | 65535   | R   |
| 79-84   | Reserved  | -                  | 0       | 0       | R   |

## DETAILS OF SOME REGISTERS

### REGISTER 2 – BAUD RATE

Code of speed used in Modbus communication.

| Code | Baud rate |
|------|-----------|
| 0    | 1.200     |
| 1    | 2.400     |
| 2    | 4.800     |
| 3    | 9.600     |
| 4    | 19.200    |
| 5    | 38.400    |
| 6    | 57.600    |
| 7    | 115.200   |

### REGISTER 3 – MODBUS ADDRESS

Address of the device in the Modbus network. Valid values: from 1 to 247. We recommend using the lower addresses for the equipment.

### REGISTER 4 – PARITY

Code of the parity used in Modbus communication.

| Code | Parity    |
|------|-----------|
| 0    | No parity |
| 1    | Odd       |
| 2    | Even      |

### REGISTER 5 – FIRMWARE VERSION

Indicates the firmware version of the equipment, according to the examples below:

If the version is "1.00", the value "100" will be read. If the version is "2.04", the value "204" will be read.

### REGISTER 6 – DIAGNOSTIC STATE TIMER

Internally used by the DigiConfig software.

### REGISTER 7 – STATE OF THE DIGITAL INPUTS

Bit at 0: Input deactivated

Bit at 1: Input activated

|       |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
|-------|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Bit   | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Entry | -  | -  | -  | -  | -  | -  | - | - | - | - | - | - | 4 | 3 | 2 | 1 |

**REGISTER 16 – CONFIGURATION OF THE DIGITAL INPUTS**

Only bit 0 is used.

Bit 0 in 0 - Input 1 operates as normal counter input

Bit 0 in 1 - Input 1 operates as fast counter input. Debounce for input 1 is ignored

**REGISTER 17 – PRESET, INHIBITING AND SELECTING THE MARGIN OF THE COUNTERS**

**Preset:** When setting the bit corresponding to the input, the counter of that input will assume the value in the respective register as preset value of the counts (registers 26 to 33). After that, the bit will be reset to zero automatically.

**Inhibition:**

Bit in 0 - Count enabled

Bit in 1 - Count disabled (suspended)

**Selection of margin:**

Bit in 0 - Count at the positive margin (0 for 1)

Bit in 1 - Count at the negative margin (1 for 0)

| Bit              | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------------------|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| Input Preset     | -  | -  | -  | -  | -  | -  | - | - | - | - | - | - | 4 | 3 | 2 | 1 |
| Input Inhibition | -  | -  | -  | -  | -  | -  | - | 4 | 3 | 2 | 1 | - | - | - | - | - |
| Input Margin     | -  | -  | -  | -  | 4  | 3  | 2 | 1 | - | - | - | - | - | - | - | - |

**REGISTERS 34 TO 58 – TAGS**

DigiRail features some identification Tags, where characters can be written in order to help identifying the device and its inputs:

- Identification tag of the device (10 characters).
- Identification tag of the input points (10 characters for each input).

**REGISTER 59 – PULSE COUNTING INTERVAL TIME**

Time interval on which input pulses are totalized and stored on registers 63 to 70. This time is in 0.1 seconds units, e.g., a value of 10 means a 1 second interval. When we configure a 1 second interval, the counting will be in Hertz (Hz - pulses per second). When we configure this interval to zero, the counting is disabled.

**REGISTER 60 – PEAK PULSE COUNTING INTERVAL TIME**

Time interval on which input pulses are totalized and, in case they are bigger than the current value, they are stored on registers 71 to 78. This time is in 0.1 seconds units, e.g., a value of 10 means a 1 second interval. When we configure this interval to zero, this feature is disabled.

**REGISTER 62 – DIGIRAIL MODEL**

Provides the code of the DigiRail model. Internally used by the DigiConfig software.

| Model | Amount |
|-------|--------|
| 2A    | 1      |
| 2R    | 3      |
| 4C    | 4      |