



# DigiRail-2A

## Universal Analogical Input Modules

# COMMUNICATION MANUAL

### INTRODUCTION

The **DigiRail-2A** 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 or under the website [www.novus.com.br](http://www.novus.com.br), for download.

### 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 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 INPUT REGISTERS - 04H

This command can be used for reading the current value of one or several input channels, according to the table below.

Address	Description
0	PV of Channel 1 in percentage. Range from 0 to 62000.
1	PV of Channel 2 in percentage. Range from 0 to 62000.
2 – 4	Reserved
5	PV of Channel 1 in engineering unit. Range: defined by the limits of the temperature sensor, or by the indication limits as defined by the parameters 42 and 43 of the <i> Holding Registers</i> .
6	PV of Channel 2 in engineering unit. Range: defined by the limits of the temperature sensor, or by the indication limits as

Address	Description
	defined by the parameters 44 and 45 of the <i>Holding Registers</i> .
7-9	Reserved

The specified *addresses* correspond to the low level physical addresses, where zero (0) corresponds to the address of PLC 30001.

### **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	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	Analogical input filter	0	20	R/W
7	Status flags of the input channels	0	65535	R
8	Reserved	0	0	R
9	PV of channel 1 in percentage	0	62000	R
10	PV of channel 2 in percentage	0	62000	R
11-13	Reserved	0	0	R
14	PV of channel 1 in engineering unit	-31000	31000	R
15	PV of channel 2 in engineering unit	-31000	31000	R
16-20	Reserved	0	0	R
21	Input type of channel 1	-1	21	R/W
22	Input type of channel 1	-1	21	R/W
23-25	Reserved	0	0	R
26	Measuring unit of channel 1	0	1	R/W
27	Measuring unit of channel 2	0	1	R/W
28-30	Reserved	0	0	R
31	User offset of channel 1	-16000	16000	R/W
32	User offset of channel 2	-16000	16000	R/W
33-35	Reserved	0	0	R
36	Square root fitness for channel 1	0	1	R/W
37	Square root fitness for channel 2	0	1	R/W
38-40	Reserved	0	0	R
41	Lower indication limit of channel 1 when input type is linear	-31000	31000	R/W
42	Upper indication limit of channel 1 when input type is linear	-31000	31000	R/W
43	Lower indication limit of channel 2 when input type is linear	-31000	31000	R/W
44	Upper indication limit of channel 2 when input type is linear	-31000	31000	R/W
45-50	Reserved	0	0	R
51	Lower indication limit of channel 1	-31000	31000	R
52	Upper indication limit of channel 1	-31000	31000	R
53	Lower indication limit of channel 2	-31000	31000	R
54	Upper indication limit of channel 2	-31000	31000	R
55-60	Reserved	0	0	R

Address	Description	Minimum	Maximum	R/W
61	Diagnostic state timer (in tenths of seconds)	0	600	R/W
62	DigiRail model	0	4	R
63-125	Reserved	0	0	R
126	Device tag - characters 1 and 2	0	65535	R/W
127	Device tag - characters 3 and 4	0	65535	R/W
128	Device tag - characters 5 and 6	0	65535	R/W
129	Device tag - characters 7 and 8	0	65535	R/W
130	Device tag - characters 9 and 10	0	65535	R/W
131	Channel 1 tag - characters 1 and 2	0	65535	R/W
132	Channel 1 tag - characters 3 and 4	0	65535	R/W
133	Channel 1 tag - characters 5 and 6	0	65535	R/W
134	Channel 1 tag - characters 7 and 8	0	65535	R/W
135	Channel 1 tag - characters 9 and 10	0	65535	R/W
136	Channel 2 tag - characters 1 and 2	0	65535	R/W
137	Channel 2 tag - characters 3 and 4	0	65535	R/W
138	Channel 2 tag - characters 5 and 6	0	65535	R/W
139	Channel 2 tag - characters 7 and 8	0	65535	R/W
140	Channel 2 tag - characters 9 and 10	0	65535	R/W
141	Tag of the channel 1 unit - characters 1 and 2	0	65535	R/W
142	Tag of the channel 1 unit - characters 3 and 4	0	65535	R/W
143	Tag of the channel 1 unit - characters 5 and 6	0	65535	R/W
144	Tag of the channel 1 unit - characters 7 and 8	0	65535	R/W
145	Tag of the channel 1 unit - characters 9 and 10	0	65535	R/W
146	Tag of the channel 1 unit - characters 1 and 2	0	65535	R/W
147	Tag of the channel 2 unit - characters 3 and 4	0	65535	R/W
148	Tag of the channel 2 unit - characters 5 and 6	0	65535	R/W
149	Tag of the channel 2 unit - characters 7 and 8	0	65535	R/W
150	Tag of the channel 2 unit - characters 9 and 10	0	65535	R/W

## **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 – ANALOGICAL INPUT FILTER**

In order to reduce the effect of high frequency external interferences on the measurements performed by the equipment, caused by electromagnetic noise existing in the environment of its installation, the signals read from the sensors are internally filtered. When choosing a low value for the filter, rough measure variations may be possible. If there is much noise in the environment where the sensors are installed, a higher value should be chosen for filtering rough measure variations.

**REGISTER 7 – STATUS FLAGS OF THE INPUT CHANNELS**

Will inform errors and special conditions in processing the input channels through setting of their bits.

Bit	Information
0	Error at the conversion/processing of the channel 1 sensor
1	Error at the conversion/processing of the Pt100 excitation cable of channel 1
2	Underflow at channel 1
3	Overflow at channel 1
4	Indicates the unit used at channel 1
5	Not used
6	Not used
7	Not used
8	Error at the conversion/processing of the channel 2 sensor
9	Error at the conversion/processing of the Pt100 excitation cable of channel 2
10	Underflow at channel 2
11	Overflow at channel 2
12	Indicates the unit used at channel 2
13	Not used
14	Not used
15	Not used

**REGISTERS 9 AND 10 – PV OF THE CHANNELS IN PERCENTAGE**

Will inform the value of the channels in a linear scale between 0 and 62000, before transforming in engineering unit.

**REGISTERS 14 AND 15 – PV OF THE CHANNELS IN ENGINEERING UNITS**

Will inform the value of the channels in the configured engineering unit.

**REGISTERS 21 AND 22 – CHANNELS INPUT TYPE**

Will define the input type configured for the channel, according to the table below.

Configuratio n	Sensor	Range
-1	DISABLED	
0	TC J	-130 a 940
1	TC K	-200 a 1370
2	TC T	-200 a 400
3	TC E	-100 a 720
4	TC N	-200 a 1300
5	TC R	0 a 1760
6	TC S	0 a 1760
7	TC B	500 1800
8	Pt100	-200 a 650
9	50mV	0 to 62000 (-31000 to 31000)
10	20mV	0 to 62000 (-31000 to 31000)
11	-10 to 20mV	0 to 62000 (-31000 to 31000)
12	5V	0 to 62000 (-31000 to 31000)
13	10V	0 to 62000 (-31000 to 31000)
14 - 17	reserved	-
18	0 to 20mA	0 to 62000 (-31000 to 31000)
19	4 to 20mA	0 to 62000 (-31000 to 31000)
20 - 21	reserved	-

**REGISTERS 26 AND 27 – MEASURING UNITS OF THE CHANNELS**

Will define the measuring unit for the channel when the input type is configured as thermocouple or Pt100.

Bit at 0 - °C

Bit at 1 - °F

**REGISTERS 31 AND 32 – OFFSET OF THE CHANNELS**

Allows performing small adjustments at the indication of the channel values. This parameter must be treated as a whole number with sign.

**REGISTERS 36 AND 37 – SQUARE ROOT FITNESS OF THE CHANNELS**

Enables/disables the indication of the square root of the channel values. Only valid when the input type is configured as being linear (mV, V or mA).

Bit at 0 - Does not extract square root

Bit at 1 – Extracts square root

**REGISTERS 41 TO 44 – INDICATION LIMITS OF THE LINEAR CHANNELS**

Will define the lower and upper indication limits of the channels when the input type is configured as being linear (mV, V, mA). This parameter must be treated as a whole number with sign.

**REGISTERS 51 TO 54 – INDICATION LIMITS OF THE CHANNELS**

Will inform the lower and upper indication limits of the channels. This parameter must be treated as a whole number with sign.

**REGISTER 61 – DIAGNOSTIC STATE TIMER**

Data in tenths of seconds, used internally by the DigiConfig software.

**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

**REGISTERS 126 TO 150 – TAGS**

DigiRail features some identification Tags, where characters can be written in order to help identifying the device, its input channels and the units used when the input type is configured as being linear (mV, V or mA):

- Identification tag of the device (10 characters).
- Identification tag of the input channel (10 characters for each input channel).
- Identification tag of the engineering unit when the input type is configured as being linear (10 characters for each input channel).