



DigiRail-2A

INPUT MODBUS MODEL – INSTRUCTIONS V1.0x

INTRODUCTION

The ModBus Module of Analog Inputs **DigiRail-2A** is a 32mm and 35mm rail-mounted unit of remote measurement. It has one or two configurable analog inputs. A serial interface RS485 allows inputs reading and device configuration through a communication network.

The module constantly measures inputs and makes them available in internal registers. Different Modbus commands are available to read registers:

Read Holding Registers – 03H

Read Holding Registers – 04H

The module is factory adjusted and no further calibration is required from the user. Factory setting:

J Sensor, °C, Filter 0

Address 247, Baudrate 1200, Parity: Par, 1 Stop Bit

If required, the user can change settings by following the instructions described in the **Configuration** section in this manual.

Note: For module calibration, check if the required excitation current for Pt100 is compliant to the Pt100 excitation current used in the module. 700uA.

Inputs are electrically isolated from the serial interface and power supply. There are no electric isolation between inputs, and between serial interface and power supply.

CONFIGURATION

Use the **DigiConfig** software to configure the device. It gives access to all parameters that define the module operation mode. To install, run the **DigiConfig Setup.exe** file and follow the installation instructions.

An error of serial port configuration may occur when other software is using the same serial port. Close all applications that use the serial port configured to DigiConfig before running it.

The fields in the DigiConfig main screen are:

Search options: Allows the user to find elements in the communication network. The user can define an address range, with an initial and a final address.

In the **Temporaries** option, DigiConfig looks for modules that were not identified yet or that are under identification process. When **Search** is pressed, the software looks for devices with 246 and 247 addresses and 1200 bps baudrates. When found, they are displayed in the field **Devices**.

Information This field displays module identification data. Such information must be provided to the manufacturer in case any technical assistance is required. A title (name) can be defined for the device selected.

Communication: Allows the user to define the communication parameters of the device selected: Communication **address, baud rate, parity** and **stop bits**.

Channels configuration: Input type, input unit, indication limits and a specific name for each input channel are defined in the **channels configuration** field.

In **Diagnosis** the user visualizes how the variables measured behave. A digital **Filter** may be applied in order to reduce oscillations in measurements taken. Intensity can be adjusted from **0** to **20**. It is factory adjusted at **0** intensity and it is always valid for both channels.

Initial Configuration

All modules have the same initial configuration and communication parameters.

Address: 247 / Baudrate: 1200 / Parity: Par, 1 Stop Bit 1

Before use, alone or in an instrumentation network, the devices must have their parameters adjusted to the application. To change the current configuration, a connection between the device and a computer with the **DigiConfig** software installed must be provided.

In a single connection, the user must select **Temporaries** in the field **Search option**, and press the button **Search**. The software will look for connected devices with the addresses 246 and 247. Results will be displayed in the **Devices** window.

When the device is selected in the **Devices** screen, the DigiConfig software loads its configuration. Make the necessary changes and press **Apply** to set the new configurations.

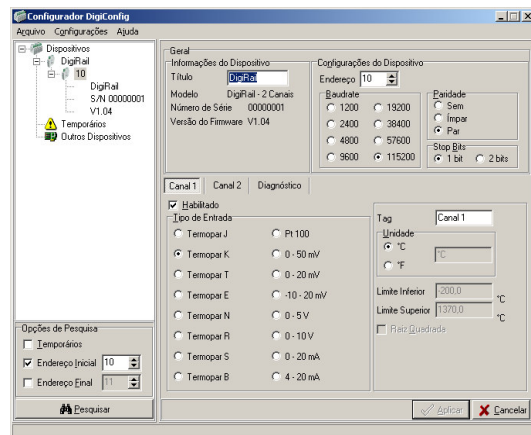


Figure 1 – DigiConfig main screen

After the device configuration is set, it is not temporary anymore and it is identified by its new communication address.

In installations with more than one device, individual installations are required, so that further addressing conflicts are prevented.

Changing configuration

Modules that were already used and with unknown configuration have their configurations changed temporarily after the **RCom** key is pressed, located right below the frontal panel:

Address: 246 / Baudrate: 1200 / Parity: Par, 1 Stop Bit 1

In a search performed by DigiConfig, the temporary device found will be displayed in the window **available Devices**. When the device is selected, the DigiConfig software loads its respective configuration. The user must then make the necessary changes and press **Apply** to set up the new configuration.

After the device configuration is set, it is not temporary anymore and it is identified by its new communication address.

Notes: Pressing RCom in more than one device at a time is not allowed. If there is more than one device with the RCom key pressed, there will be different devices with the same address (246). Under such conditions, DigiConfig will identify no equipment.

Changes made in the communication parameters with the RCom key pressed will be valid for 60 seconds. After this time, if no communication with this module is established, the communication parameters will be the same as before RCom key was pressed.

ELECTRICAL INSTALLATION

Installation recommendations

- Conductors of input signals must be distant from activation or high-tension/current conductors, preferably passing through grounded conduits.
- A specific electrical power supply network should be provided for instruments-use only.
- In controlling and monitoring applications, possible consequences of any system failure must be considered in advance.
- RC filters (47R and 100nF, serial) in inductor charges (contactors, solenoids, etc.) are recommended.

Electrical connections

The figure below shows the required electrical connections. Input signals (temperature sensors, voltage and current signals) use the terminals 1, 2, 3, 7, 8 and 9. When measuring Pt100 with two wires, the terminals 2 and 3 in Channel 1 and terminals 8 and 9 in Channel 2 must be tightened together.

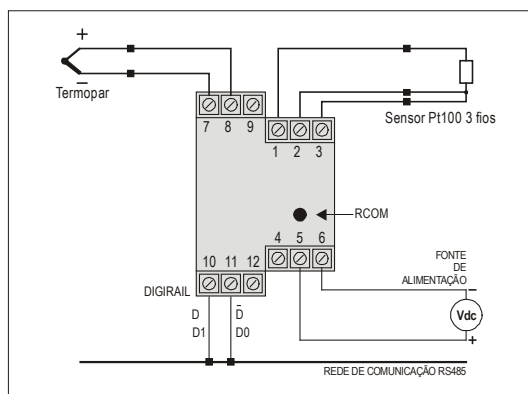


Figure 3 – Electrical connections

Electrical connections - 0-5Vdc / 0-10Vdc input

For 0-5Vdc and 0-10Vdc inputs, a small intervention in the module internal circuit must be provided by the user. The module must be opened and jumpers J1 and J2 (input 1 and input 2, respectively) must be changed:

- For 0-10Vdc input, positions 1 and 2 must be soldered
- For other inputs, positions 2 and 3 must be soldered (factory provided).

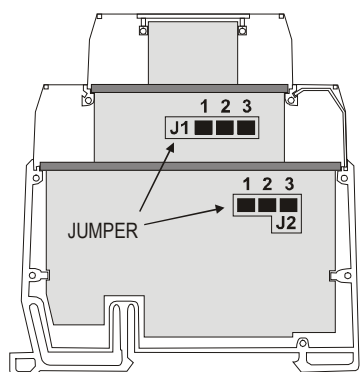


Figure 4 – Jumper for the 0-10Vdc input

Note: When requested, models can be factory provided at -5Vdc and 0-10Vdc inputs.

SPECIFICATIONS

Input signal: Configurable. Input signals accepted are listed in Table 1, with the respective measure ranges.

Thermocouples: Thermocouple types J, K, T, R, S, B, N and E, in compliance to NBR 12771.
Impedance >> 1MΩ

Pt100: 3-wires, $\alpha= 385$, NBR 13773, Excitation of 700μA
For 2-wire Pt100, interconnect terminals 2 and 3.

Other: 0 to 20mV, -10 to 20mV, 0 to 50mV: Impedance >> 1MΩ
0 to 5Vdc, 0 to 10Vdc: Impedance >> 1MΩ
0 to 20mA, 4 to 20mA: Impedance: 100Ω (+ 1.7Vdc)

Input signal	Maximum Measurement Range
Thermocouple J	-130 to 940 °C (-202 to 1724 °F)
Thermocouple K	-200 to 1370 °C (-328 to 2498 °F)
Thermocouple T	-200 to 400 °C (-328 to 752 °F)
Thermocouple E	-100 to 720 °C (-148 to 1328 °F)
Thermocouple N	-200 to 1300 °C (-328 to 2372 °F)
Thermocouple R	0 to 1760 °C (-32 to 3200 °F)
Thermocouple S	0 to 1760 °C (-32 to 3200 °F)
Thermocouple B	500 to 1800 °C (932 to 3272 °F)
Pt100	-200 to 650°C (-328 to 1202 °F)
0 to 20 mV	Adjustable between -31000 and +31000
-10 to 20 mV	
0 to 50 mV	
* 0 to 5 Vdc	
* 0 to 10 Vdc	
0 to 20 mA	
4 to 20 mA	

Table 1 – Sensor and signals accepted in the module

Total accuracy: Thermocouples: 0.25% of the minimum range, $\pm 1^\circ\text{C}$;
Pt100, voltage, current: 0.15% of the maximum range;

* **Note:** 0-5Vdc and 0-10Vdc input, in the Standard model, are not factory calibrated 5% accuracy. When adequately calibrated they can reach up to 0.15% accuracy.

Sampling rate: From 2.5 to 10 samples per second.

Power supply: 10 to 35Vdc /maximum of 50mA.

Working temperature: 0 to 70°C

Environment Humidity 0 to 90% UR

Electromagnetic compatibility: EN 50081-2, EN 50082-2

Electric isolation of inputs and power supply / serial port: 1000Vac

Internal protection against polarity inversion of the power supply voltage.

Internal cold junction compensation for thermocouples.

Thermocouples package: polyamide

Cross section: 0.14 to 4.0 mm²

Recommended torque: 0.8 Nm.

MECHANICAL INSTALLATION

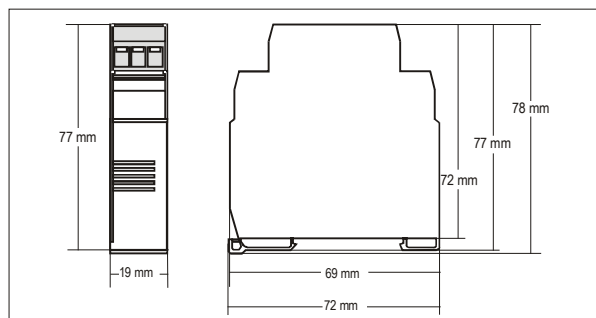


Figure 2 - Dimensions

COMMUNICATION INTERFACE

Serial interface RS485 can address up to 247 networked devices, remotely communicating with a master.

RS485 INTERFACE

- Signals compliant to the RS485 pattern.
- 3-wire connection between the master and up to 31 slaves in bus topology. With multiple output converters can reach up to 247 nodes.
- Maximum cable length: 1000 meters
- RS485 signals are:
 - D: (D1) Bidirectional data line
 - \bar{D} : (D0) Inverted bidirectional data line
 - GND: Optional connection to improve communication performance

GENERAL FEATURES

- Optic isolation in the serial interface.
- Programmable speed: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bps.
- Data bits: 8
- Programmable parity: Even, odd or no parity;
- Stop Bits: 1 or 2

COMMUNICATION PROTOCOL

It supports the MODBus RTU slave protocol, available in most market-available supervisory software.

All configurable parameters in the controller can be accessed (read and/or written) through the Register Tables. Writing registers in the broadcast mode is also allowed, by using the address 0.

Modbus commands available are:

- Read Holding Registers – 03h
- Read Input Register – 04h
- Write Single Register – 06h
- Diagnostics ("Return Query Data" sub function only) – 08h
- Read Device Identification – 2Bh

REGISTERS TABLE

In the table below, parameters are represented in 16 bits, with no signal.

Alterations of parameters other than 16 bits can be found in their respective descriptions.

Holding Registers Table

Address	Description	Minimum	Maximum	R/W
0	Serial number (word high)	0	65535	R
1	Serial number (word low)	0	65535	R
2	Baud-rate 0- 1200 1- 2400 2- 4800 3- 9600 4- 19200 5- 38400 6- 57600 7- 115200	0	7	R/W
3	Modbus address	1	247	R/W
4	Parity	0	2	R/W
5	Indicates devices firmware version: If the version is "1.00", it is read as "100"; if the version is "2.04", it is read as "204"	0	999	R
6	Analog input filtering	0	20	R/W
7	Input status Bit 0 - Channel 1 sensor error Bit 1 - Channel 1 cable error Bit 2 - Channel 1 underflow Bit 3 - Channel 1 overflow Bit 4 - Channel 1 unit Bit 8 - Channel 2 sensor error	0	65535	R

	Bit 9 - Channel 2 cable error Bit 10 - Channel 2 underflow Bit 11 - Channel 2 overflow Bit 12 - Channel 2 unit			
8	Reserved	-	-	-
9	Channel 1 PV	0	62000	R
10	Channel 2 PV	0	62000	R
11-13	Reserved	-	-	-
14	Channel 1 PV in engineering unit Range: Defined by the limits of the temperature sensor, or by the indication limits defined in parameters 41 and 42.	-31000	31000	R
15	Channel 2 PV in engineering unit Range: Defined by the limits of the temperature sensor, or by the indication limits defined in parameters 43 and 44.	-31000	31000	R
16-20	Reserved	-	-	-
21	Channel 1 input type See registers table This parameter must be considered an integer with signal.	-1	21	R/W
22	Channel 2 input type See registers table This parameter must be considered an integer with signal.	-1	21	R/W
23-25	Reserved	-	-	-
26	Channel 1 measurement unit 0: °C ; 1: °F	0	1	R/W
27	Channel 2 measurement unit 0: °C ; 1: °F	0	1	R/W
28-30	Reserved	-	-	-
31	Channel 1 offset This parameter must be considered an integer with signal.	-16000	16000	R/W
32	Channel 2 offset This parameter must be considered an integer with signal.	-16000	16000	R/W
33-35	Reserved	-	-	-
36	Channel 1 square root. Valid only for linear inputs (mV, V and mA). 0 – does not extract square roots 1 – extract square roots	0	1	R/W
37	Channel 2 square root. Valid only for linear inputs (mV, V and mA). 0 – does not extract square roots 1 – extract square roots	0	1	R/W
38-40	Reserved	-	-	-
41	Channel 1 indicator lowest limit Used to define indicator limits of linear inputs (mV, V and mA) This parameter must be considered an integer with signal.	-31000	31000	R/W
42	Channel 2 indicator highest limit. Used to define indicator limits of linear inputs (mV, V and mA) This parameter must be considered an integer with signal.	-31000	31000	R/W
43	Channel 1 indicator lowest limit Used to define indicator limits of linear inputs (mV, V and mA) This parameter must be considered an integer with signal.	-31000	31000	R/W
44	Channel 2 indicator highest limit. Used to define indicator limits of linear inputs (mV, V and mA) This parameter must be considered an integer with signal.	-31000	31000	R/W
45-50	Reserved	-	-	-
51	Channel minimum PV	-	-	R
52	Channel 1 maximum PV	-	-	R

53	Channel 2 minimum PV	-	-	R
54	Channel 2 maximum PV	-	-	R
55-60	Reserved	-	-	-
61	Diagnostic status indicator/timer	0	600	R/W
62	Provides the DigiRail model code Used internally by the DigiConfig software 1- 2A; 2 – Reserved; 3- 2R; 4- 4C;	-	-	R
63-65	Reserved	-	-	-
66-95	Input table of the customized linearization.	0	65535	R/W
96-125	Output table of the customized linearization.	0	65535	R/W
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	Channel 1 unit tag – characters 1 and 2	0	65535	R/W
142	Channel 1 unit tag – characters 3 and 4	0	65535	R/W
143	Channel 1 unit tag – characters 5 and 6	0	65535	R/W
144	Channel 1 unit tag – characters 7 and 8	0	65535	R/W
145	Channel 1 unit tag – characters 9 and 10	0	65535	R/W
146	Channel 2 unit tag – characters 1 and 2	0	65535	R/W
147	Channel 2 unit tag – characters 3 and 4	0	65535	R/W
148	Channel 2 unit tag – characters 5 and 6	0	65535	R/W
149	Channel 2 unit tag – characters 7 and 8	0	65535	R/W
150	Channel 2 unit tag – characters 9 and 10	0	65535	R/W

SENSORS TABLE

Configuration	Sensor	Range
-1	Disabled	
0	TC J	-130 to 940
1	TC K	-200 to 1370
2	TC T	-200 to 400
3	TC E	-100 to 720
4	TC N	-200 to 1300
5	TC R	0 to 1760
6	TC S	0 to 1760
7	TC B	500 1800
8	Pt100	-200 to 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	-

OBSERVATIONS

Registers 126 to 150 – TAGs

DigiRail has some identification Tags where identification characters can be written to identify the device and its outputs:

- Device identification tag (10 characters).
- Channels identification tag (10 characters per channel).
- Identification tag of measurement units of each channel (10 characters per channel).