



HER070 - ANALOG/PULSE ADD-ON BOARD DATA ACQUISITION

USER MANUAL REV0.3



Revision history

Rev.	Date	Details	Originated by
0.1	19 Jan 2010	First issue (hardware rev1)	Pierre-Emmanuel Surga
0.2	22 November 2010	Update for hardware rev2	Pierre-Emmanuel Surga
0.3	08 December 2010	Proof reading and validation	Samuel Chereau

This manual is written without any warranty.

Maestro Wireless Solutions Ltd. reserves the right to modify or improve the product and its accessories which can also be withdrawn without prior notice.

Besides, our company stresses the fact that the performance of the product as well as accessories depends not only on the proper conditions of use, but also on the environment around the places of use.

Maestro Wireless Solutions Ltd. assumes no liability for damage incurred directly or indirectly from errors, omissions or discrepancies between the modem and the manual.

Contents

1	Description	4
1.1	Overview of the HER070	4
1.2	Interfaces specifications	5
1.2.1	Enclosure	5
1.2.2	Digital inputs	5
1.2.3	Digital outputs	5
1.2.4	Analog inputs	6
2	Interfacing the HER070	7
2.1	Reading the analog inputs	7
2.2	Reading the digital / pulse inputs	8
2.3	Setting the digital outputs	9
3	Installation	10
3.1	Remove the dust cover on Main Unit (HER010)	10
3.2	Plug in the add-on	10
3.3	Fasten screws	11
3.4	Fasten screws (when using DIN Rail Clip)	11
3.5	Connect the add-on board I/O interfaces	12
4	Application examples	13
4.1	Connecting an analog sensor 4-20mA	13
4.2	Connecting a pulse emitting meter (reed type)	13
4.3	Driving a relay	14

Safety precautions

General precautions

- The modem generates radio frequency (RF) power. When using the modem care must be taken on safety issues related to RF interference as well as regulations of RF equipment.
- Do not use your phone in aircraft, hospitals, petrol stations or in places where using GSM products is prohibited.
- Be sure that the modem will not be interfering with nearby equipment. For example: pacemakers or medical equipment. The antenna of the modem should be away from computers, office equipment, home appliance, etc.
- An external antenna must be connected to the modem for proper operation. Only used approved antennas with the modem. Please contact authorized dealer on finding an approved antenna.
- Always keep the antenna with minimum safety distance of 26.6 cm or more

Protecting your modem

- To ensure error-free usage, please install and operate your modem with care. Do remember the following:
- Do not expose the modem to extreme conditions such as high humidity/rain, high temperatures, direct sunlight, caustic/harsh chemicals, dust, or water.
- Do not try to disassemble or modify the modem. There is no user serviceable part inside and the warranty would be void.
- Do not drop, hit or shake the modem. Do not use the modem under extreme vibrating condition.
- Do not pull the antenna or power supply cable. Attach/ detach by holding the connector.
- Connect the modem only according to the instruction manual. Failure to do it will void the warranty.

Chapter 1

Description

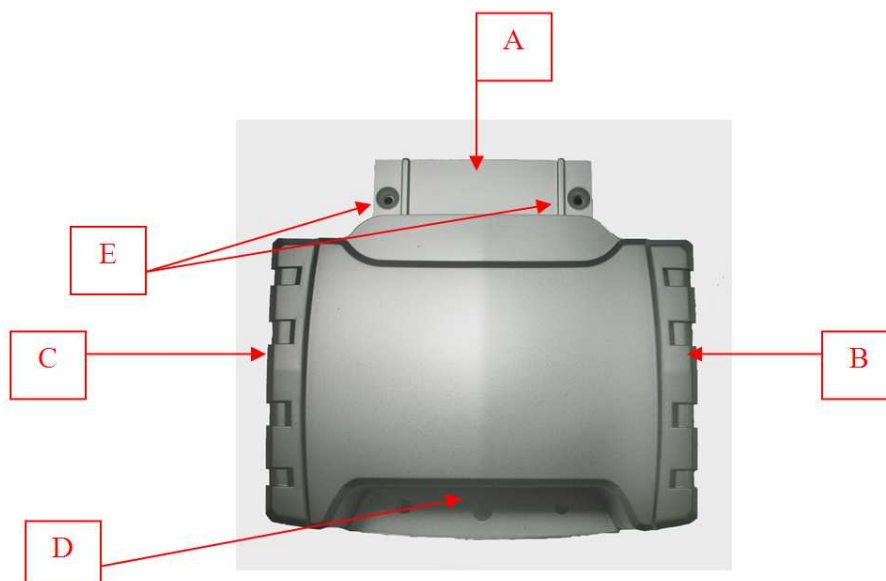
The HER070 is an optional add-on board to the Maestro Heritage Main Unit (ordering code HER010), that adds various inputs and outputs interfaces dedicated for remote metering and data acquisition applications.

The HER070 features four isolated digital outputs, four 0-10V or 0-20mA analog inputs, and four isolated digital inputs that can be used as high-speed pulse-counting channels. The HER070 can be driven by the HER010 expansion interface, and be used with various embedded application from Maestro Wireless Solutions: Softools, Autoreport, etc.

This user manual concerns the HER070 with hardware version 2. It does not apply to the prototypes series (whose serial number range from 30000001 to 30000030). If your HER070 bears a prototype serial number, please refer to the rev0.1 of this document.

This document is intended to provide support to software developers and installers. For more details about software that support this add-on board and how to use it, please refer to the user manual of that software.

1.1 Overview of the HER070



- A: Expansion connector (to HER010 Heritage Main Unit)
- B: Analog inputs connectors
- C: Digital outputs connectors
- D: Digital pulse-counting inputs connectors

1.2 Interfaces specifications

1.2.1 Enclosure

The HER070 is made of PC/ABS plastic, rated to UL-94V0 flammability.

It features several mounting holes, two of these being designed to securely mate the add-on board and the Heritage main units. Additional holes can be used to mount the wireless gateway in an electrical cabinet, etc.

Note: The assembly of HER010 and HER070 can be fit with the Heritage DIN clip, for mounting on a 35mm industrial rail.

1.2.2 Digital inputs

There are four digital inputs on the HER070. Each digital input can either work as regular opto-isolated digital input that are similar to the digital input of the other Heritage add-on boards (voltage mode), either in dry contact mode to directly interface with pulse generating devices, for example water or power meters.

In voltage mode, the digital input is considered to be at low level when a voltage of 0V is applied at the input, and is at high level when a voltage of 5V to 32V is applied. 32V is the maximum absolute rating of the digital input.

In dry contact mode, one pin of the digital input will become an isolated 5V voltage source. This allows a relay or a dry contact to be directly connected across the two pins of the digital input and trigger the opto-isolated input.

The 5V voltage source is enabled/disabled using the **GPIO28** signal of the Q26 processor of the Heritage main unit. When using the digital inputs as regular voltage triggered inputs, it is recommended to switch off the voltage source to reduce the modem power consumption and prevent false reading of the input (the HER070 is protected against overvoltage, applying a reverse voltage between 5V and 32V will not damage the voltage source).

The digital inputs can be used as high speed pulse counters. The HER070 will detect a pulse when it sees a rising edge followed by a high level maintained for at least 800us on any of the digital inputs.

1.2.3 Digital outputs

The four digital outputs of the HER070 are opto-isolated open-collector type. Each digital output is fit with a rectifier diode so that it can be used to directly drive external relays.

The digital outputs support a voltage of 60V DC and have a rated current of 100mA.

Being open-collector type, the digital outputs do not issue any voltage information, but rather a change in the output status will result in a change of the impedance of the output. This can be converted to a voltage signal

using an external voltage source and an external pull-up / pull-down resistor. This gives more flexibility to the installer of the modem.

1.2.4 Analog inputs

The HER070 is fit with four analog inputs. They can directly interface with analog sensors with a 0-10V voltage output, or with the standard 0-20mA or 4-20mA current output.

The analog inputs are differential and have a 16 bits resolution (the HER070 uses two dedicated ADC chips, it does not use the Q26 internal ADC). The input type (voltage or current) can be set using Q26 GPIO signals, and works by activating or not a shunt resistor that will reduce the input impedance from 5kOhm (voltage mode) to 500mA (current mode).

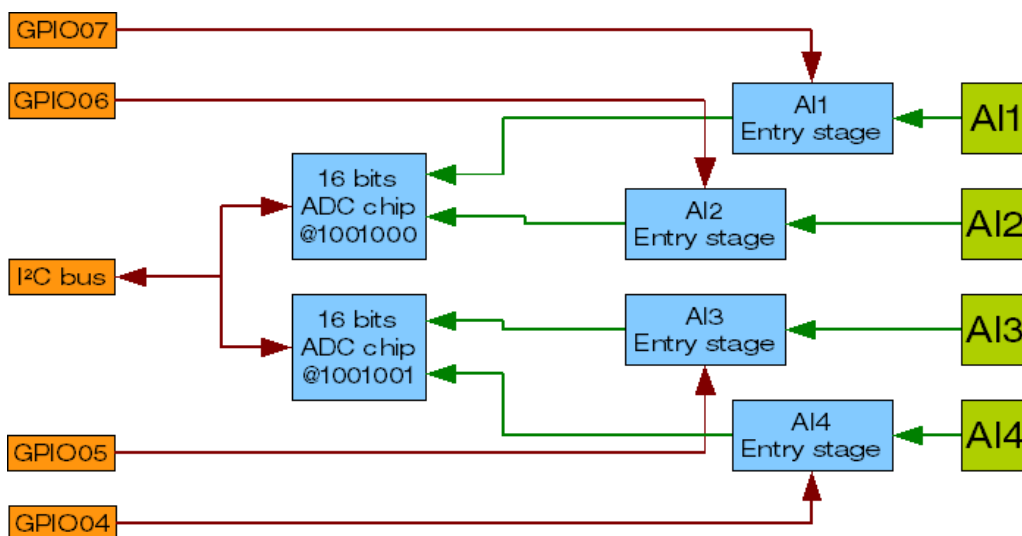
The analog inputs do not provide a power source to power an external sensor. An external power source is required (preferably this power source has to be isolated from the HER010 power source).

Chapter 2

Interfacing the HER070

2.1 Reading the analog inputs

The HER070 uses two external ADC chips, that are two 16 bits ADS1115 from TI. It does not use the Q26 internal ADC.

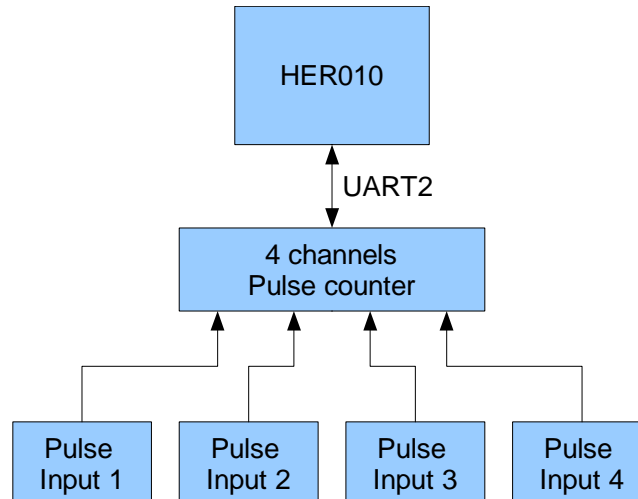


Four GPIO signals of the Q26 processor are used to set the input impedance of the analog input: 5kOhm (voltage mode) or 500Ohm (current mode): these GPIO are active low, which means that the input impedance of the analog channel is 500Ohm when the GPIO is low, and 5kOhm when the GPIO is high.

The ADC are read from the I2C bus of the Q26, using openAT. If you are writing your own openAT application, please refer to the datasheet of the ADS1115 for more details about how to read it or consult your Maestro Wireless Solutions representative for assistance. Maestro Wireless Solutions provides several ready-to-use solutions to read the analog inputs remotely, please contact us for details.

2.2 Reading the digital / pulse inputs

The HER070 uses a dedicated FPGA based pulse counter circuit to count the four pulse input channels. This pulse counter communicates with the HER010 using the UART2 bus of the wireless microprocessor.



Due to this architecture, it is necessary to use an openAT application to read the pulse registers.

You need to setup the UART2 of the Q26 as 115200bps, 8N1, and no flow control. Then, send ASCII characters '1' (0x31) to '4' (0x34) to respectively reset the counters 1 to 4. Send ASCII character '5' (0x35) to read the values of the counters. The FPGA will reply a message in the following format:

```
0x31 0xAA 0xAA 0x32 0xBB 0xBB 0x33 0xCC 0xCC 0x34 0xDD 0xDD 0x35 0xEE 0x0A 0x0D
```

Where:

- 0xAA 0xAA is the hex value of the 16 bits counter for channel 1
- 0xBB 0xBB is the hex value of the 16 bits counter for channel 2
- 0xCC 0xCC is the hex value of the 16 bits counter for channel 3
- 0xDD 0xDD is the hex value of the 16 bits counter for channel 4
- 0xEE is a byte determining the values of the digital inputs in a manner of a bit mask:
 - 1: input 1 only is high
 - 2: input 2 only is high
 - 4: input 3 only is high
 - 8: input 4 only is high
 - 6: input 2 and 3 are high, the others are low
 - 7: input 1 and input 2 and input 3 are high, input 4 is low

The FPGA does not save the counter values between power loss or resets of the modem. The host application must take care of saving these values, for example in the non-volatile memory of the HER010 or on a remote server, in order to avoid losing metering data.

Maestro Wireless Solutions provides several ready-to-use solutions to read the digital and pulse inputs remotely, please contact us for details.

2.3 Setting the digital outputs

The digital outputs of the HER070 are directly mapped to GPIO35, GPIO34, GPIO30 and GPIO31 signals of the HER010 microcontroller as described in the following table:

Microcontroller signal	Digital output
GPIO35	1
GPIO34	2
GPIO30	3
GPIO31	4

The GPIO signals must first be set as outputs:

```
AT+WIOM=1,"GPIO35",0
AT+WIOM=1,"GPIO34",0
AT+WIOM=1,"GPIO30",0
AT+WIOM=1,"GPIO31",0
```

Then you can set the outputs with the following commands:

```
AT+WIOW="GPIO35",0 set output 1 to 0
AT+WIOW="GPIO35",1 set output 1 to 1
AT+WIOW="GPIO34",0 set output 2 to 0
AT+WIOW="GPIO34",1 set output 2 to 1
AT+WIOW="GPIO30",0 set output 3 to 0
AT+WIOW="GPIO30",1 set output 3 to 1
AT+WIOW="GPIO31",0 set output 4 to 0
AT+WIOW="GPIO31",1 set output 4 to 1
```

The digital outputs can be set from an openAT application in a similar manner.

Maestro Wireless Solutions provides several ready-to-use solutions to control the digital outputs of the modem remotely, please contact us for details.

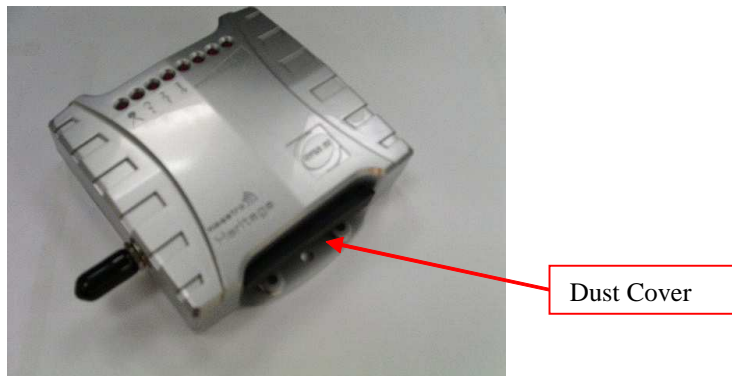
Chapter 3

Installation

Note: This chapter does not cover the installation of the HER010 main unit itself. Please refer to the HER010 user manual for details.

3.1 Remove the dust cover on Main Unit (HER010)

This will expose the mounting slot; the connector pins can be seen inside the slot.



3.2 Plug in the add-on

Align the connector end of HER070 and slide it into the mounting slot. The ribs on the connector end guide the sliding action. Push until the connector goes all the way in. The action is normally very smooth.



3.3 Fasten screws

Use the 2 screws sized M2x6 and 2 spring washers, supplied together with HER070, to secure the two units in position.



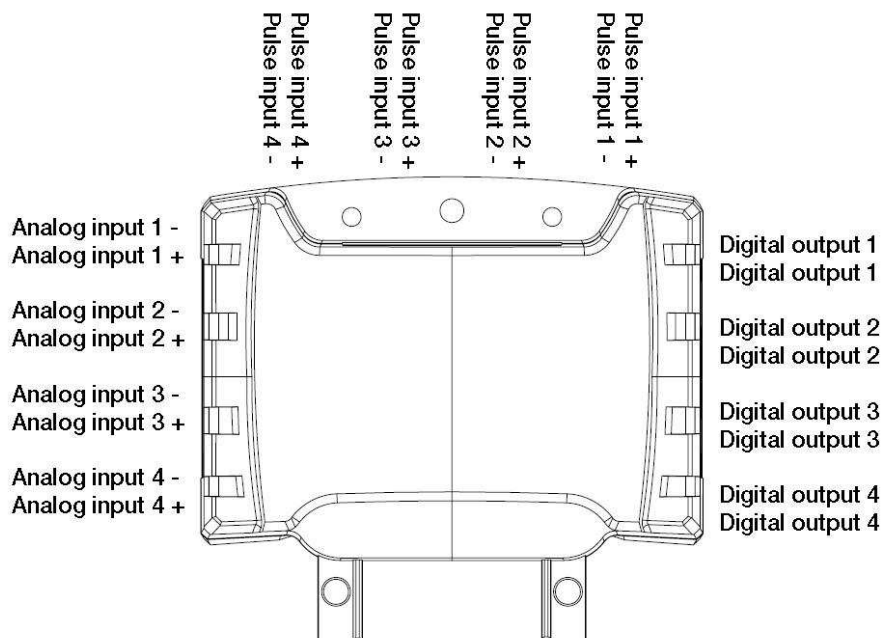
3.4 Fasten screws (when using DIN Rail Clip)

Use the 2 screws sized M2x10 and 2 spring washers, supplied together with DIN Rail Clip, to secure the two units in position. The screw threads are to go through 2 mounting holes on the Clip before fastening the two units.



3.5 Connect the add-on board I/O interfaces

Use a screwdriver to secure the wires to the terminal blocks. Make sure you follow the correct pin out assignment:

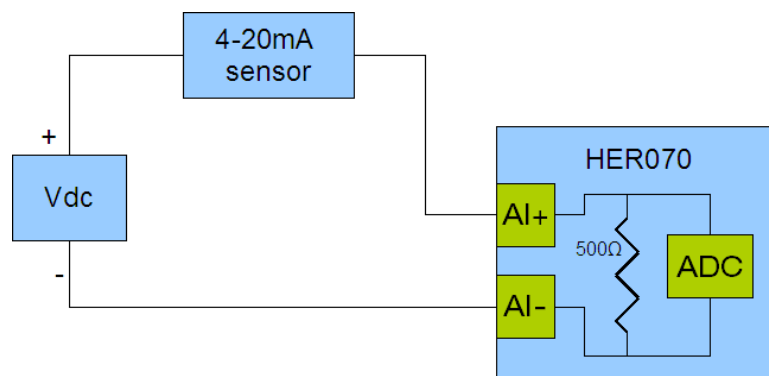


Chapter 4

Application examples

4.1 Connecting an analog sensor 4-20mA

A 4-20mA transducer is a type of sensor that will output a regulated current between 4mA and 20mA. This type of transducer can be directly connected to the HER070 as shown in this diagram:



Before you connect the sensor, make sure that the analog input stage of the HER070 is set to have an input impedance of 500Ohm or the modem may be damaged.

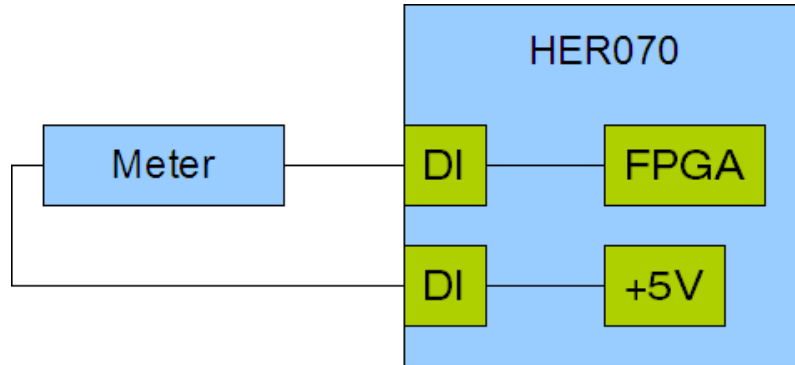
Please verify that in any case, no current above 20mA or a voltage above 10V will be applied to the analog input. Each analog channel of the HER070 is protected by an transient / ESD suppressor diode. This diode will start to conduct at 12V and will short the analog channel, which may cause damages to the HER070 and the connected equipment.

In order to limit noise and keep a clean signal, it is recommended to use twisted wires or shielded cables when connecting the sensor to the HER070.

4.2 Connecting a pulse emitting meter (reed type)

A lot of water, gas and electricity meters (but also wind speed sensors and many other equipments) can output pulses in the form of a relay or an open collector transistor that gets from high to low impedance for a short time (or vice versa). These transducers can be directly connected to the HER070 by simply connecting them between the two connectors of one digital input channel.

Prior to that, you need to enable the +5V isolated voltage source inside the HER070 by forcing the GPIO28 signal to low level (or leave it unassigned).



4.3 Driving a relay

The digital outputs of the HER070 are open collector type and can sustain a current of 100mA. Although this is enough to drive small loads such as a LED or a buzzer, you need to add an external relay to the add-on board if it is required to control a bigger load. The digital outputs of the HER070 have been designed for such application, and an external relay can be interfaced with a minimum number of components.

