HER070 Add-on box with 4 analog inputs, 4 digital outputs and 4 digital pulse-counting inputs

WORKING PROTOTYPE USER MANUAL

Rev. 0.1

REVISION HISTORY

Rev.	Date	Details	Originated by
0.1	19 Jan 2010	First release	Pierre-Emmanuel Surga

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 reserves the right to modify or improve the product and its accessories which can also be withdrawn without prior notice.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

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SAFETY PRECAUTIONS

General

The user must operate the product according to the specifications described in this User Manual.

Make sure the ratings and performance characteristics of the product are sufficient for the systems, machines and equipment.

Warnings

Do not attempt to unplug the product from the Main Unit when the latter is being supplied power.

Do not attempt to disassemble, modify or repair the product. Any attempt to do so may result in malfunction or fire.

Provide safety measures in external circuit to ensure safety in the system in case of abnormality occurs due to malfunction of the product or another external factor affecting the product's operation. Safety measures include but not limited to Emergency stop circuits, interlock circuits and limit circuits.

The digital outputs may remain ON or OFF in case the OptoRelay is damaged. As a counter-measure for such problem, external safety measures must be provided to ensure safety in the system (see application note at the end of this document for details).

Construct a control circuit so that the power supply for the I/O circuits does not come ON before power supply for the Heritage Main Unit.

If there is risk of high voltage surge appearing on I/O circuits, then use a different power supply for the I/O circuits from the one for the Heritage Main Unit. **The two power supplies will need to be isolated.**

CHAPTER 1: Introduction

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

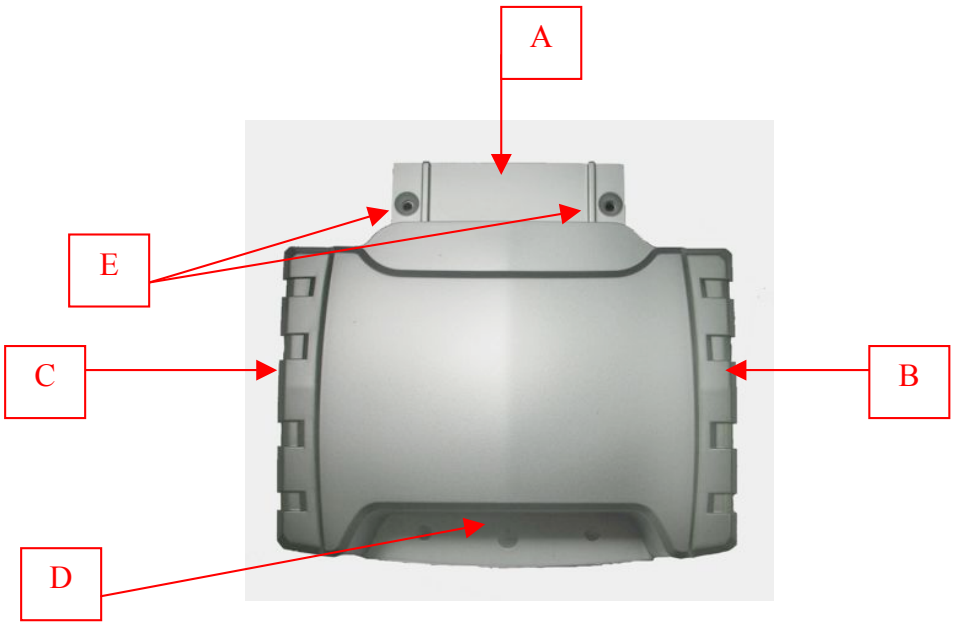
The HER070 features four opto-isolated digital outputs, four 0-10V or 0-20mA analog inputs, and four opto-isolated digital inputs that can be used as high-speed pulse-counting channels.

The HER070 can be driven by AT commands sent on the HER010's interfaces (serial port, SMS or GPRS).

To use the pulse counting / digital input feature of the HER070, you need to have the Heritage Softools rev 0.92ea (beta version) or more recent loaded in the HER010

This user manual concerns the HER070 working prototypes, whose serial number range from 30000001 to 30000030. If your HER070 bears another serial number, please ask your Maestro representative for a updated manual.

1. Overview of HER040



A: Expansion connector (to main unit)

B: Analog inputs connectors

C: Digital outputs connectors

D: Digital pulse-counting inputs connectors

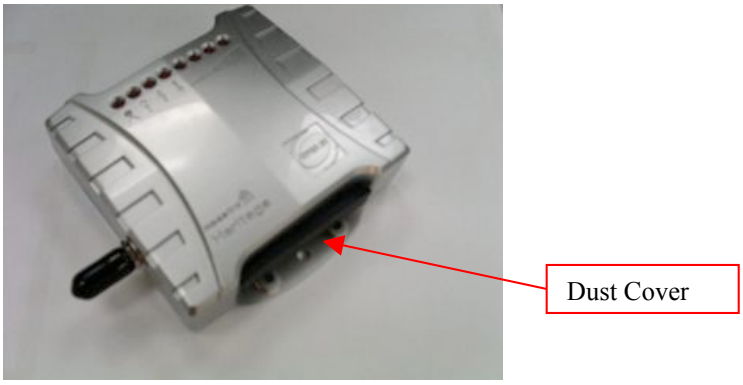
CHAPTER 2: Specifications

Item		
Enclosure		PC/ABS plastic UL-94V0 flammability
Digital input	Type	Opto-Coupler x 4
	ON voltage	5Vdc min 32Vdc max
	OFF voltage	0Vdc min 1.0Vdc max
	Pulse counting	Up to **TBD** pulses per second A pulse is a rising edge followed by a high level maintained for at least 800us. 16 bits counters
Output port	Type	Isolated Transistor output x4 for driving relays
	Operating voltage	60V DC Max
	Current carrying capacity (continuous)	100mA max
Analog inputs	Voltage range	0-10V
	Current range	0-20mA
	Error	1.5% maximum <1% typical
	Resolution	1635 steps
Operating Temperature		-40 to +85 deg C
Storage Temperature		-40 to +85 deg C
Weight		75g
Overall Dimension		100(L)x75(W)x28(H)mm

CHAPTER 3: Install HER070 on the Main Unit

1. Remove the dust cover on Main Unit (HER010)

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

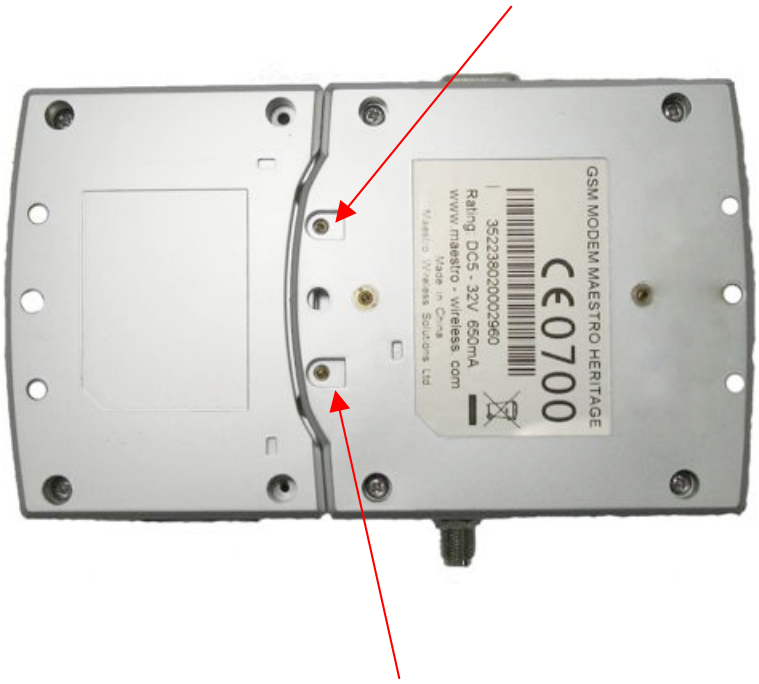


2. Plug in the add-on

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. Fasten screws

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



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.

5. Install the SIM card

(please refer to HER010 Manual for more details)

Use a ball pen or paper clip to press the SIM holder eject button. The SIM holder will come out a little. Then take out the SIM holder.

Note: DO NOT pull out the SIM holder without pushing the ejector.

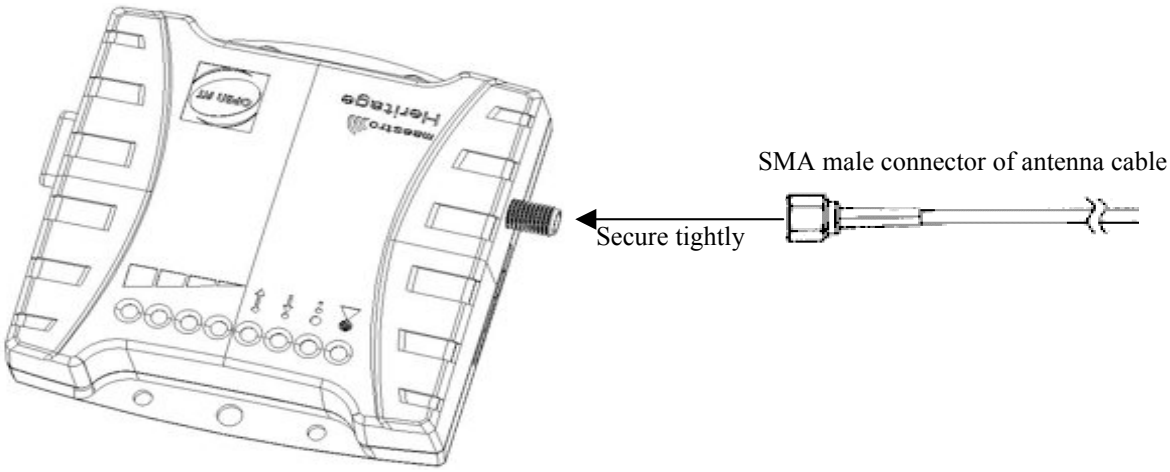
Put the SIM card to the tray; make sure it has completely sat on the tray. Put the tray back into the slot.

6. Connect the external antenna (SMA type)

(please refer to HER010 Manual for more details)

Connect this to an external antenna with SMA male connector. Make sure the antenna is for the GSM 900/1800 or GSM 850 / 1900 frequency with impedance of 50ohm, and that the connector is secured tightly.

Note: Please use antenna designed for GSM 900/1800 or GSM 850 / 1900 MHz operation. Incorrect antenna will affect communication and even damage the modem.

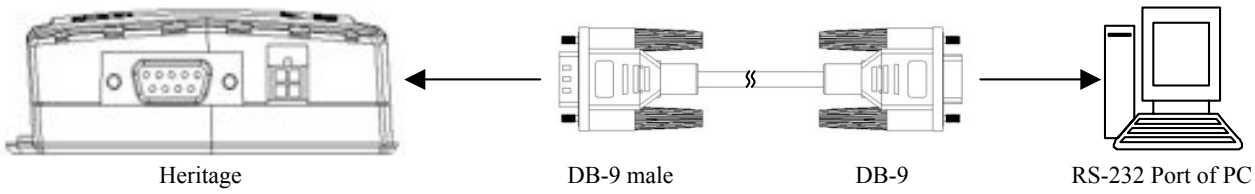


7. Connect the main unit to computer (optional)

(please refer to HER010 Manual for more details)

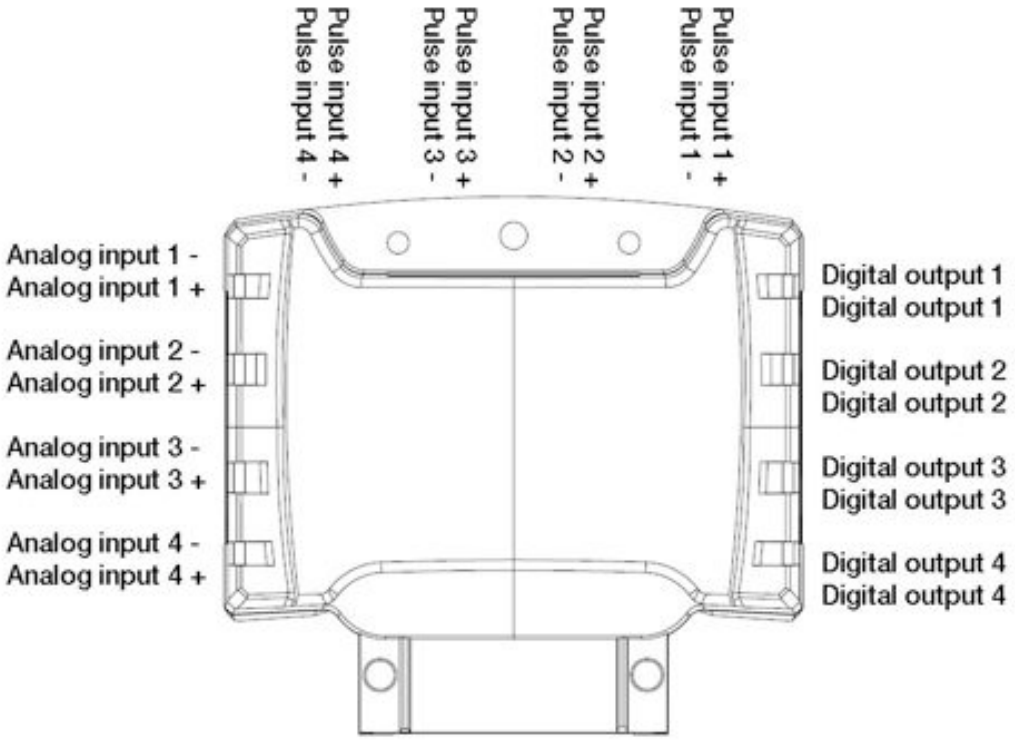
If you need to configure or diagnostic the Heritage main unit, you can use the RS232 cable to connect the modem's Sub-D connector to an external computer.

Connection example using RS232 cable:



8. 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:



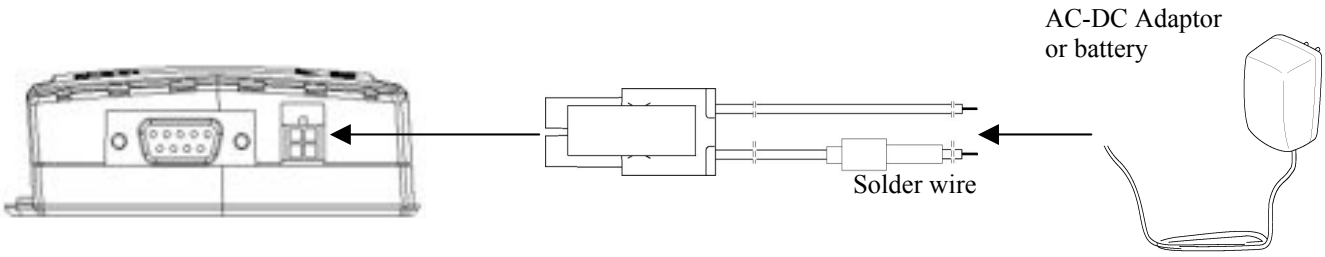
Refer to the notes at the end of this document for application schematics.

9. Connect the DC power supply

(please refer to HER010 Manual for more details)

Connect the open ending of the inducted power cord to a DC supply. Refer to the following for power supply requirement.

Input voltage range	5V – 32V
Rated current	500 mA



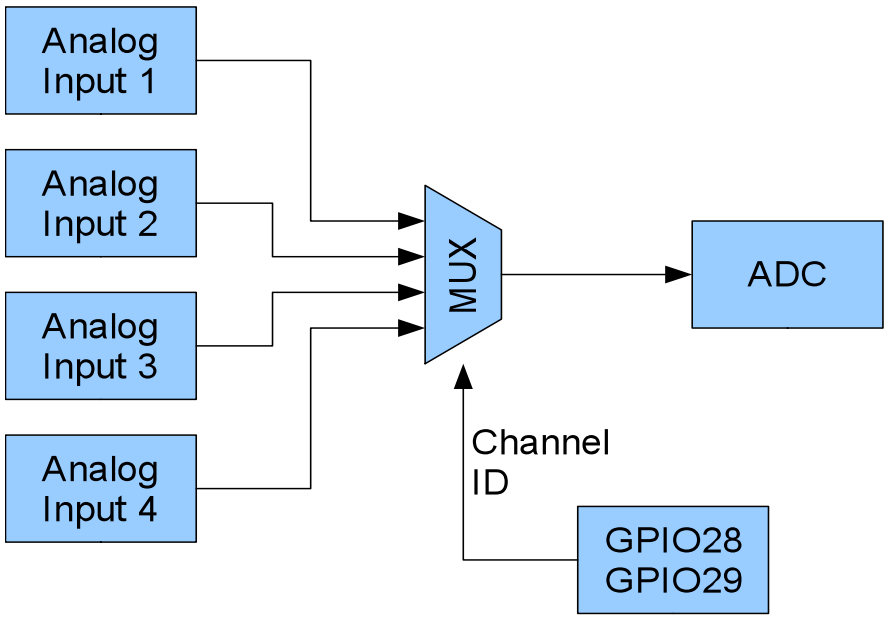
Connect the connector to the modem. The modem will turn on automatically.

The status indicator on the modem will be lit when power on. After a few seconds it will go flashing slowly.

CHAPTER 4: USING THE HER070 ADD-ON BOARD

1. Reading the analog inputs

The HER070 uses a multiplexer that carries all the four analog inputs to the ADC interface of its microprocessor. The multiplexer channel is selected by the GPIO28 and GPIO29 signals of the microprocessor:



The multiplexer follows the following assignment table:

GPIO28	GPIO29	Analog channel
0	0	1
1	0	2
0	1	3
1	1	4

The analog channels can be read by AT commands (local or remote AT commands) by typing the following:

For the analog input 1:

```
AT+WIOW=”GPIO28”,0
AT+WIOW=”GPIO29”,0
AT+ADC?
```

For the analog input 21:

```
AT+WIOW=”GPIO28”,1
AT+WIOW=”GPIO29”,0
```

```
AT+ADC?
```

For the analog input 3:

```
AT+WIOW=”GPIO28”,0
AT+WIOW=”GPIO29”,1
AT+ADC?
```

For the analog input 4:

```
AT+WIOW=”GPIO28”,1
AT+WIOW=”GPIO29”,1
AT+ADC?
```

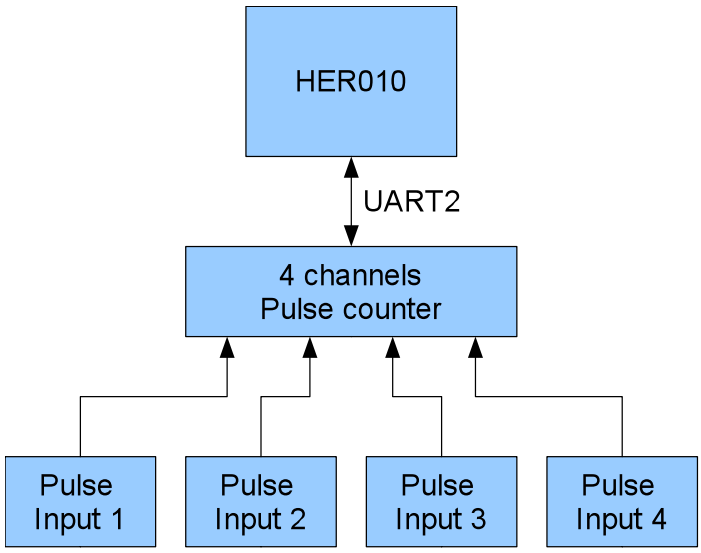
Prior to sending these commands, you need to configure GPIO28 and GPIO29 as outputs. This is done with the following commands:

```
AT+WIOM=1,”GPIO28”,1
AT+WIOM=1,”GPIO29”,1
```

The analog inputs can be read by openAT applications in a similar manner. Be careful to take the switching delay of the GPIO into account when you select a channel to read.

2. *Reading the 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.



To read the values of the different pulse channels, you can rely on the Softools functions that drive the HER070.
To enable the HER070 as the current add-on board:

AT+HPLUGIN=5

To reset the value of a particular pulse channel to zero:

AT+CNTRESET=x (where x = 1, 2, 3 or 4)

To reset the four pulses counters:

AT+CNTRESET

To read the values of the pulses counters:

AT+CNTREAD

Expected reply:

+CNTREAD : <ch1>, <ch2>, <ch3>, <ch4>, <di1>, <di2>, <di3>, <di4>
<ch1>: channel 1 counter value
<ch1>: channel 2 counter value
<ch1>: channel 3 counter value
<ch1>: channel 4 counter value
<di1>: channel 1 current value: 0 if low, 1 if high
<di2>: channel 2 current value: 0 if low, 2 if high
<di3>: channel 3 current value: 0 if low, 4 if high
<di4>: channel 4 current value: 0 if low, 8 if high

It is also possible to read the counters directly in openAT. You need to setup the UART2 as 115200bps, 8N1, and no flow control. Then, send ASCII characters '1' (0x31) to '4' (0x34) to 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
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
Etc..;

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.

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
```

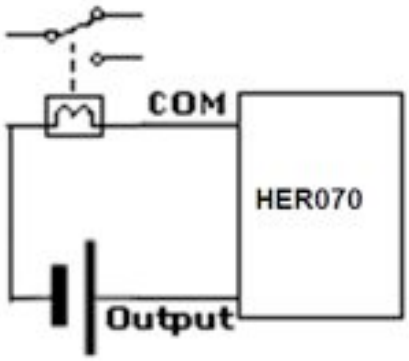
Then you can set the outputs with the following commands:

```
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
```

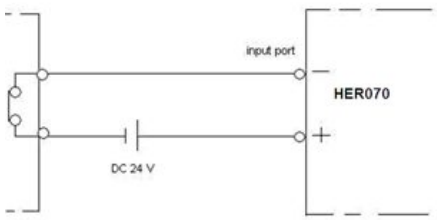
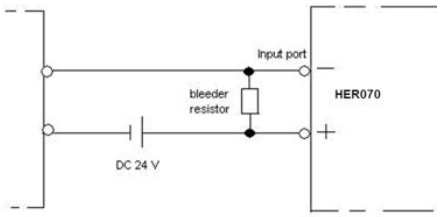
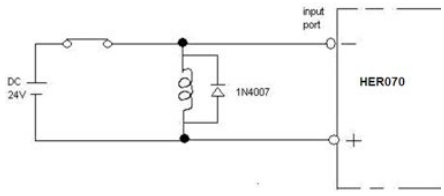
The digital outputs can be set from an openAT application in a similar manner.

CHAPTER 5: WIRING OF INPUTS / OUTPUTS

1. Digital output Wiring

Case	Circuit examples	Characteristics	Caution
1		Use DC type mechanical relay to extend the output circuit for driving heavier load.	Relay is inductive. There is already a diode inside the board to protect against flyback voltage, so there is no need to add an external one Use a relay power supply that is isolated from the HER010 power supply.

2. Input Wiring

Case	Circuit examples	Characteristics	Caution
1		The input port is switched ON when a DC voltage between 5V to 32V is applied.	Voltage driving the input ports must be DC. Make sure the polarity is correct and voltage does not exceed 32V. Use a power supply that is isolated from the HER010 power supply.
2		A leakage current can cause false ON inputs. This could happen when using sensors that have a small leakage in OFF state.	To prevent a false ON input, insert a bleeder resistor in the circuit to reduce the input impedance.
3		When connecting an inductive load to an input.	Connect a diode (e.g. 1N4007) in parallel with the load as shown to prevent flyback voltage from damaging the input port.