User Manual

2024/03/19, v1.0.3

HRT-370

(HART signal Filter)



Written by Edward

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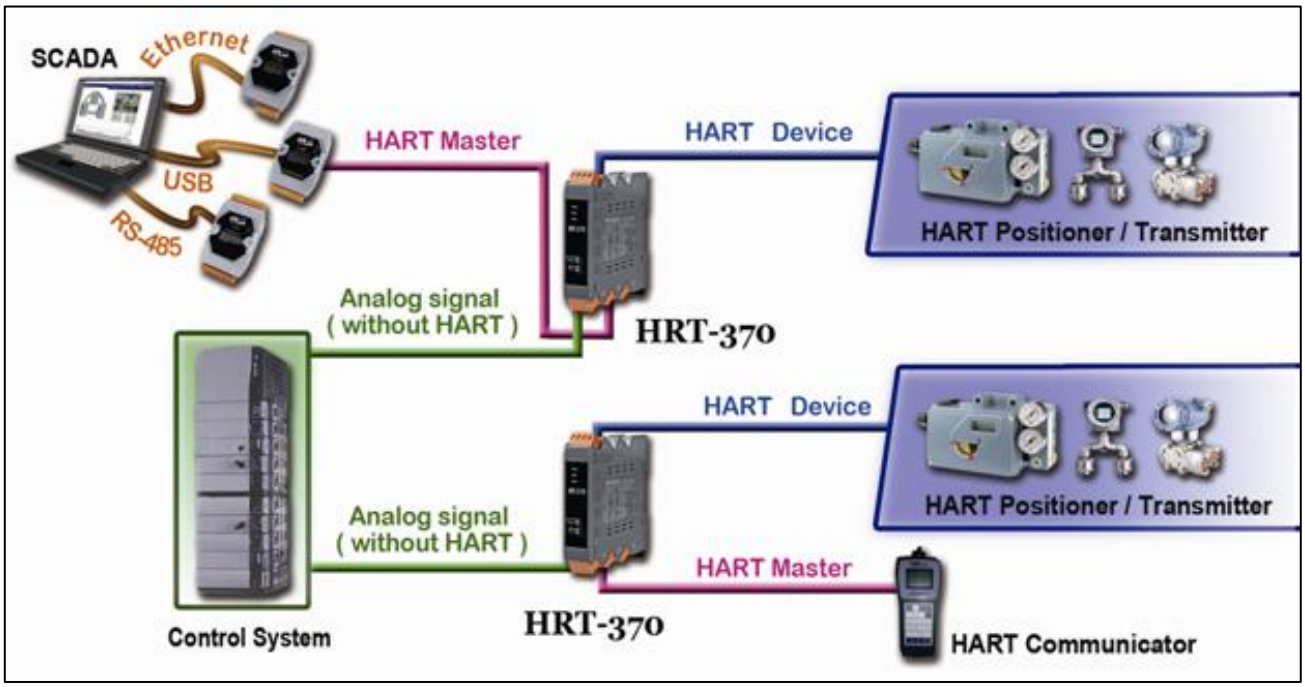
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1. Introduction

HART protocol is a global standard for sending and receiving digital information across analog wires between smart devices and controlling or monitoring system, hence many factories see the HART communication as a digital upgrade for the existing plants. However while adding the HART digital signals onto the original analog signal, the value of the original analog current signal may get interfered. In order to solve this issue, ICP DAS has developed a new HART product, the HRT-370.

The HRT-370 module is a HART signal Filter. When connecting HRT-370 to a HART instrument, it splits the HART slave signal to two channels, one keeps the original HART signal and another filers the HART digital signal out to output a pure analog signal. Therefore, users can make both HART and analog current data collection and processing easier and more precise by applying HRT-370 in the HART network. The HRT-370 module has specially designed to pass 4KV ESD protection, 2500V_{DC} isolation and a wide operating temperature meaning that it can be used in harsh environments. The HRT-370 module contains three LED indicators, one is used to indicate the status of the module power, one is to indicate whether HART slave device connected and the last one is used to indicate whether the analog output loop connected.



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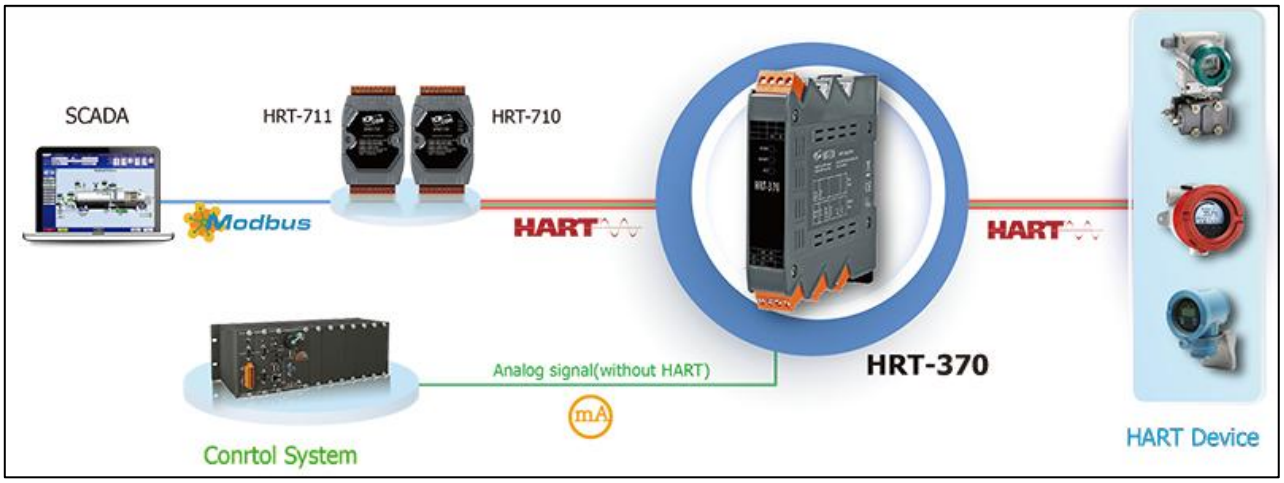


Figure 1: The application of HRT-370

1.1 Features

- **Hardware**
  - 1 analog current output (HART signal filter) channel
  - 1 by pass HART signal channel
  - Supports input voltage 10~30V_{DC}.
  - Supports input current 4~20mA
  - Supports HART Burst mode
  - Supports point-to-point HART mode
  - Allows two HART masters
  - Supports Loop Power function (module provides +30V)
  - Provides 3 LED indicators (PWR/ HART/ AO)
  - 4KV ESD Protection
  - 2500V_{DC} isolation
  - 250Ω, 2W load resistor
  - RoHS Design
  - Supports din-rail installation
- Software
  - Not required

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1.2 Specification

Module	HRT-370
HART Interface	
HART Connector	One 4-pin screwed terminal block (LP+, H+, H-)
HART Device	2-wired or 4-wired HART devices (Point to Point)
4KV ESD Protection	Yes
Isolation Voltage	2500 VDC
Loop Power	Yes (module provides +30V output)
Auxiliary Supply	24V @ 20mA
Input Impedance	250Ω±5% (2W)
Analog Output Interface	
Analog Output Connector	One 4-pin screwed terminal block (IOUT+, IOUT-)
Current Output Capacity	External +30V @ 800Ω (Sink)
Zero/Span Drift (25℃)	4~20mA ± 0.1% FSR
Zero/Span Drift (-30/+80℃)	4~20mA ± 0.5% FSR
Response Time	40ms @ 250 Ω
Isolation Voltage	2500VDC
Power	
Power Supply	Unregulated +10 ~ +30 V_{DC}
Protection	Power reverse polarity protection, Over-voltage brown-out protection
Power Consumption	Maximum: (20mA) => 0.05mA @ 30VDC, 1.5W
Mechanical	
Installation	DIN-Rail
Dimension (W x L x H)	25mm x 116mm x 120mm
LED Display	PWR: Module power status HART: HART connection status AO: AO connection status
Environment	
Operating Temperature	-25 ℃ ~ +75 ℃
Storage Temperature	-30 ℃ ~ +80 ℃
Relative Humidity	5% ~ 95% RH, non-condensing

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2. Hardware

2.1 Appearance



Front View **Side View**

Figure 2.1: HRT-370 Appearance

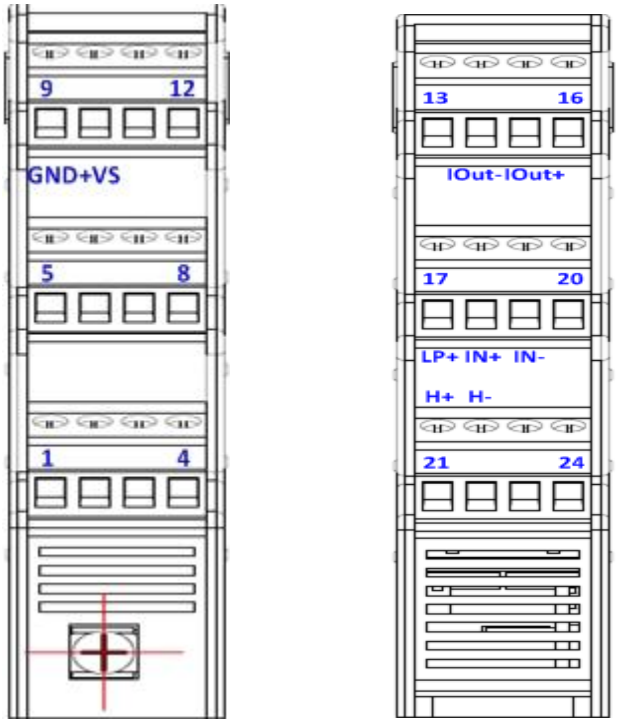
[Table 2.1: HRT-370 appearance description]

No.	Description
1	LED indicators (PWR, HART, AO)
2	Power connector (+Vs, GND)
3	Analog Output connector (Iout+, Iout-)
4	HART slave device connector (LP+, IN+, IN-)
5	HART master device connector (H+, H-)

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2.2 Pin Assignments



Top View **Bottom View**

Figure 2.2: Pin assignment of HRT-370

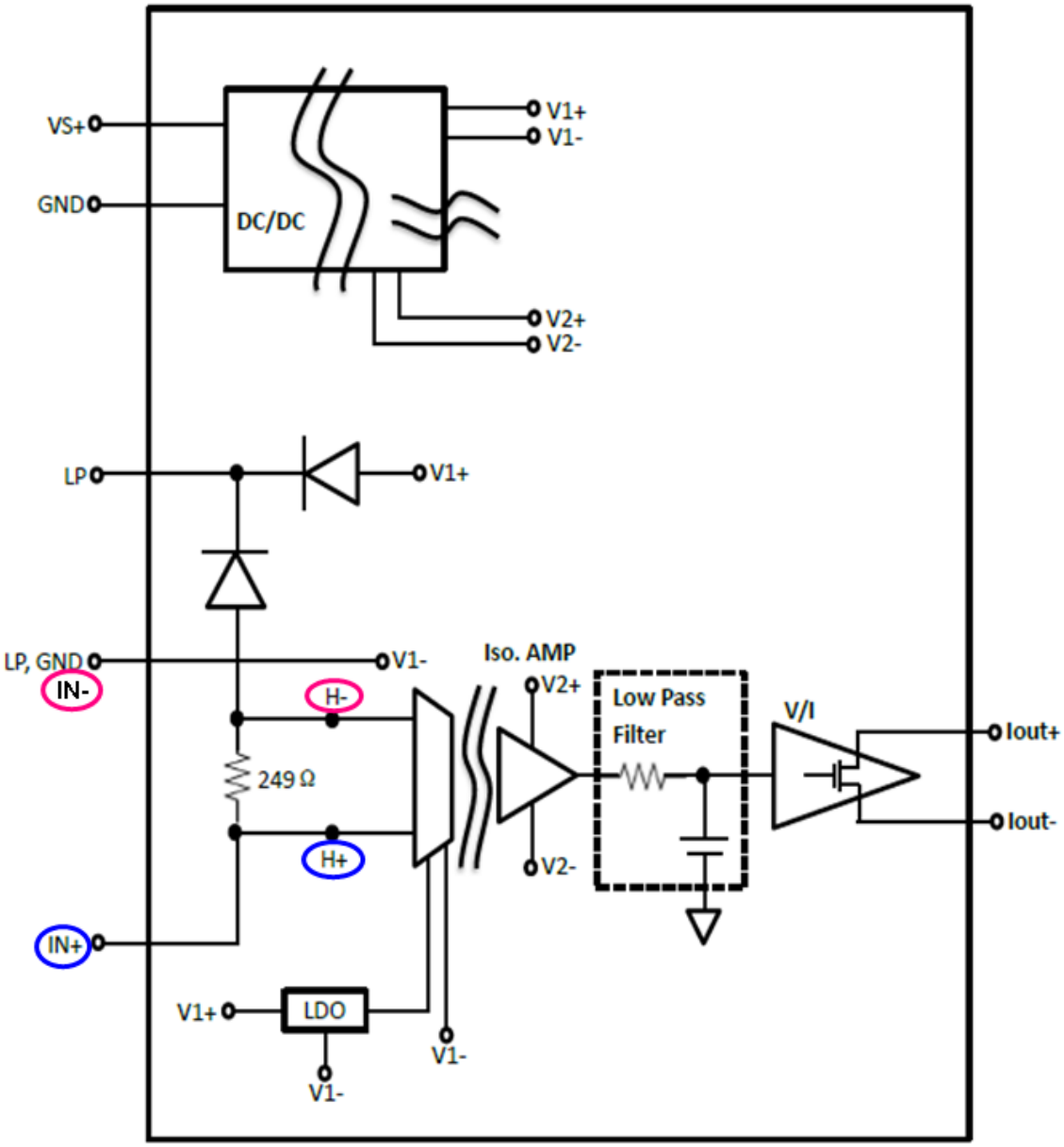
[Table 2.2: Screw terminal block]

Name	Pin No.	Description
GND	9	GND of Power Supply
+VS	10	V+ of Power Supply (+10~+30Vdc)
IOut+	15	Current AO+
IOut-	14	Current AO-
IN-	19	Negative of HART (**IN- and H- connected)**
IN+	18	Positive of HART **(IN+ and H+ connected)**
LP+	17	V+ of Loop Power (+30Vdc)
H-	22	Negative of HART (**IN- and H- connected)**
H+	21	Positive of HART **(IN+ and H+ connected)**

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2.3 Block diagram



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2.4 Wiring

HRT-370 wiring can be divided into four areas**:** **Module Power**, **HART Master**, **HART Slave** and **AO Current Output wiring**.

[1. Module power]

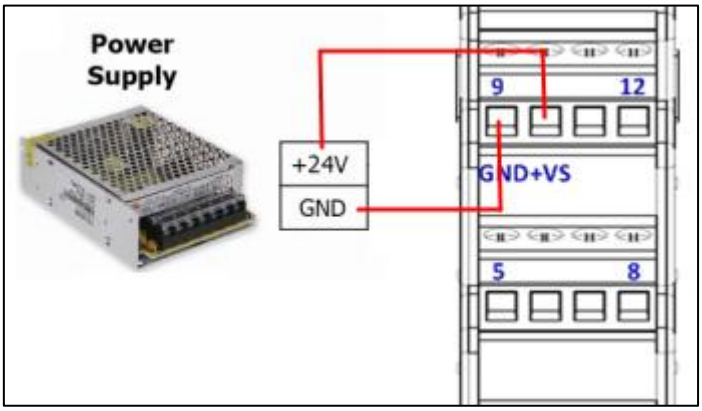
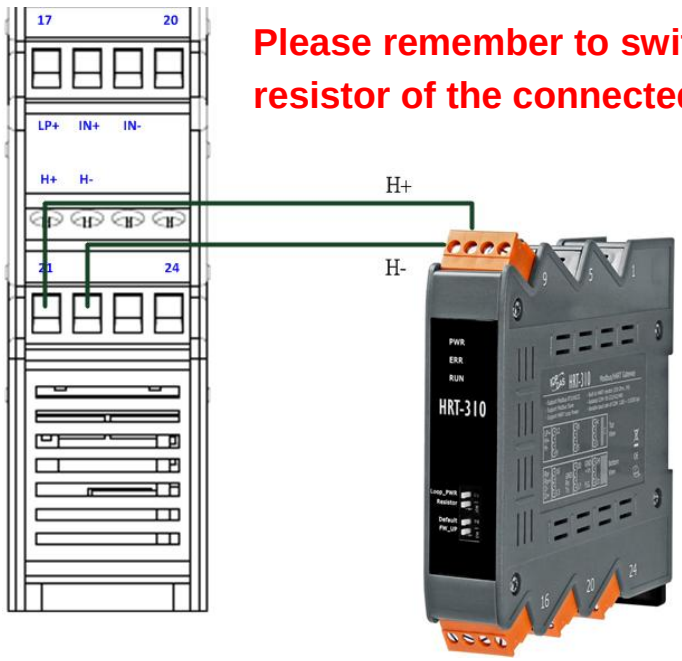


Figure 2.4.1: HRT-370 Power wiring

[2. HART Master wiring]

HART gateways or converters can be connected with HRT-370 to exam HART communication, following use a HRT-310 as example. Because the built-in resistor (250Ω, 2W) of HRT-370 cannot turned off, so please turn off the built-in resistor of master device.

Wired PIN: H+, H- (21, 22)



Please remember to switch off the built-in resistor of the connected module

Figure 2.4.1: HART Master wiring

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[3. HART Slave device wiring : (HRT-370 has 250Ω built-in resistor)]

(1) Two-wired device:

[1]. External Power wiring:

Wired PIN: IN+, IN- (18, 19)

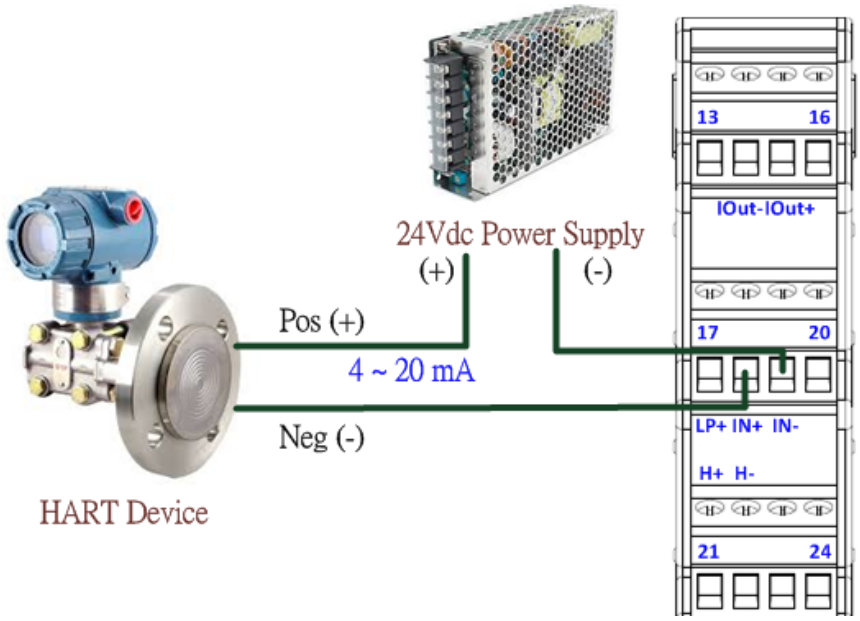


Figure 2.4.2: Two-wired device external power wiring

[2]. Module Loop Power wiring: (HRT-370 supports to provide +30V)

Wired PIN: LP, IN+ (17, 18)

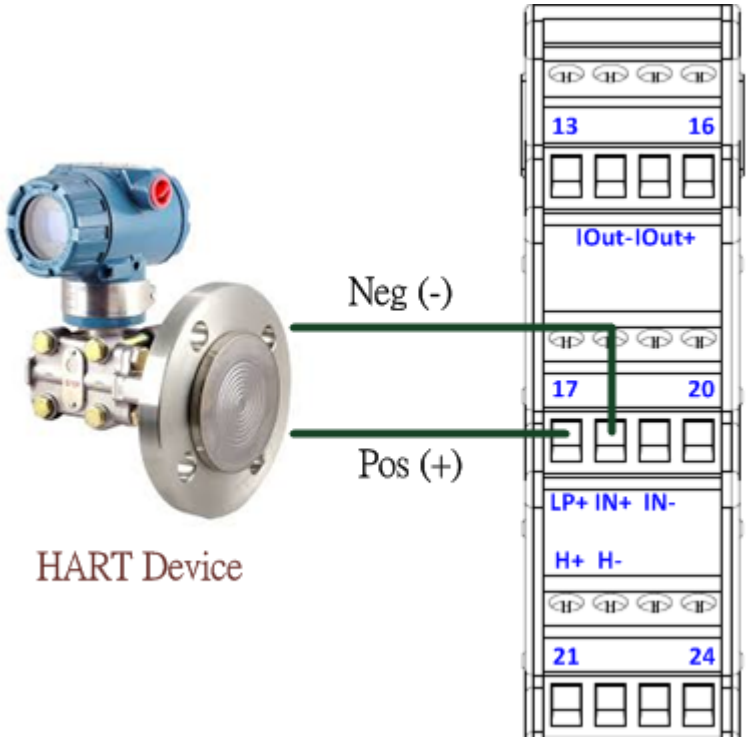


Figure 2.4.3: Two-wired device module loop power wiring

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(2) Four-wired device:

Wired PIN: IN+, IN- (18, 19)

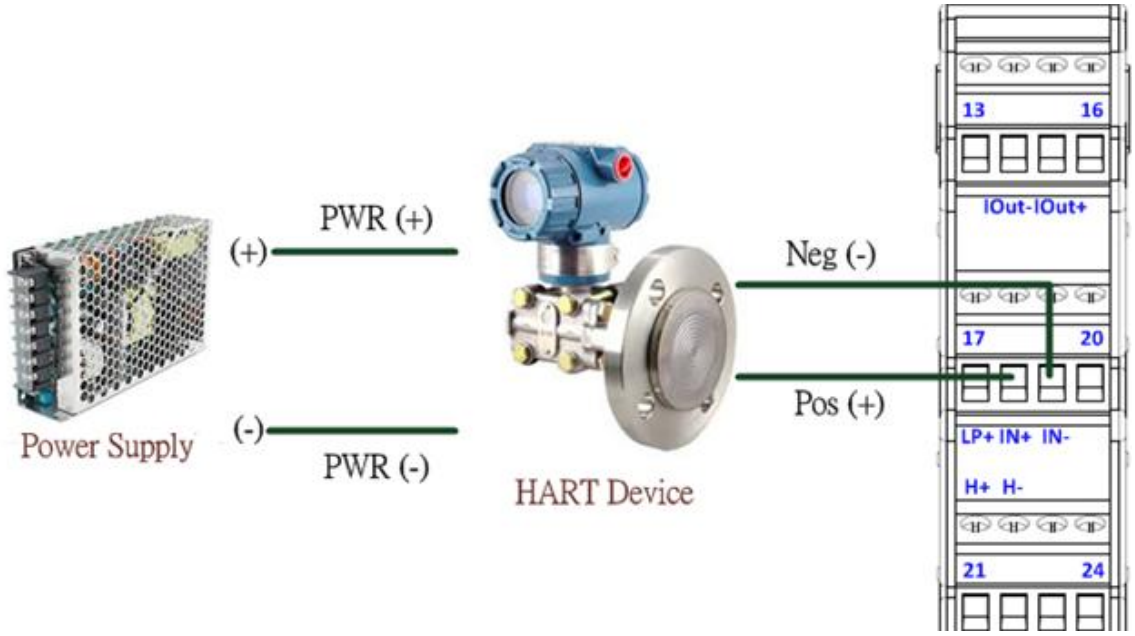


Figure 2.4.4: Four-wired device wiring

[4. Analog Current Output wiring]

M-7019 is using as an example of AI module to connect with HRT-370.

Wired PIN: IOut+, IOut- (14, 15)

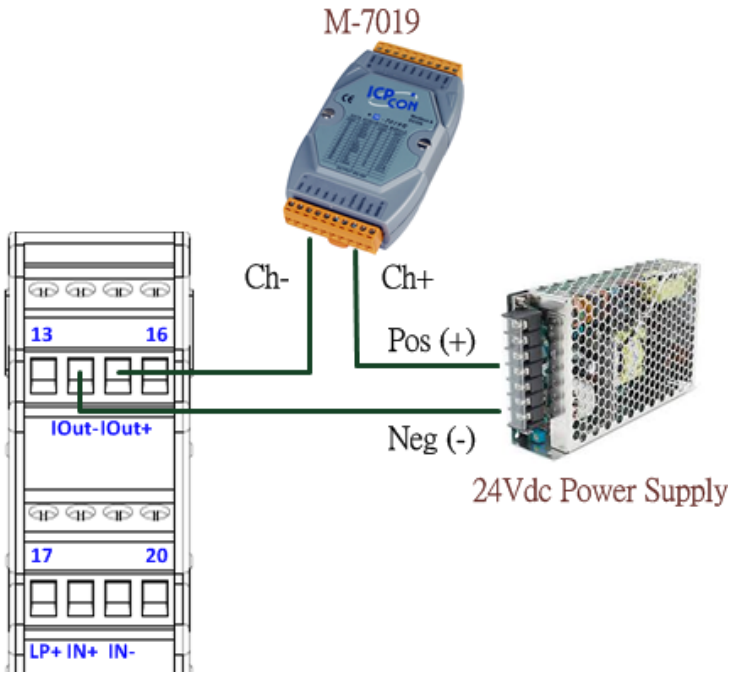


Figure 2.4.5: Analog Output wiring

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[Case Wiring]

(1) Case 1**:** There are seven HART devices using **HRT-370*7** and **HRT-711*7** (disable internal HART resistor of HRT-711) and use external power supply to HART device. Therefore, AI module of PLC can read the correct current value of all HART devices. In PC side, Modbus/TCP client can get the detailed information of all HART devices.

<1>HRT-711**:** MB/TCP to HART gateway

<2>NSM-208GP**:** Ethernet Switch

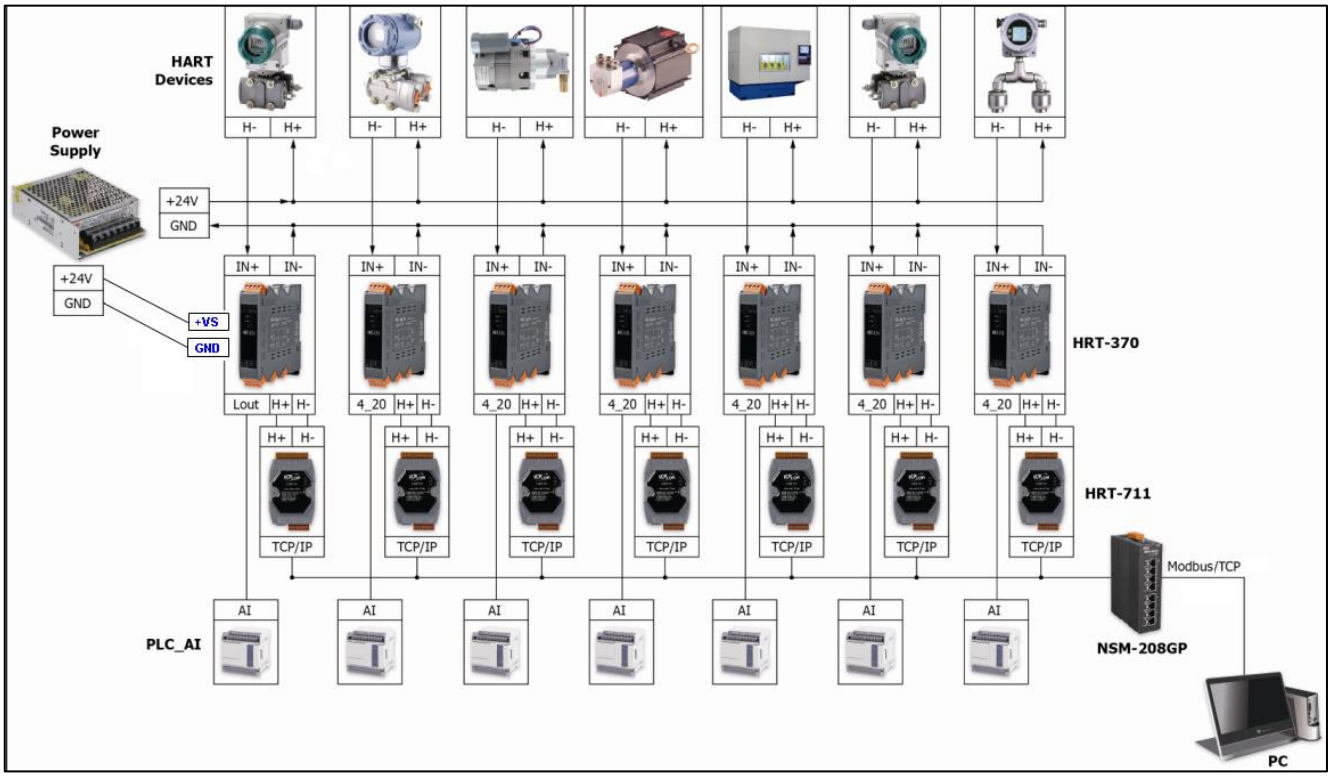


Figure 2.4.6：Case 1 wiring (HART device powered by external power supply)

(2) Case 1**:** There are seven HART devices using **HRT-370*7** and **HRT-711*7** (disable internal HART resistor of HRT-711) and use loop power of HRT-370 to HART device. Therefore, AI module of PLC can read the correct current value of all HART devices. In PC side, Modbus/TCP client can get the detailed information of all HART devices.

<1>HRT-711**:** MB/TCP to HART gateway

<2>NSM-208GP**:** Ethernet Switch

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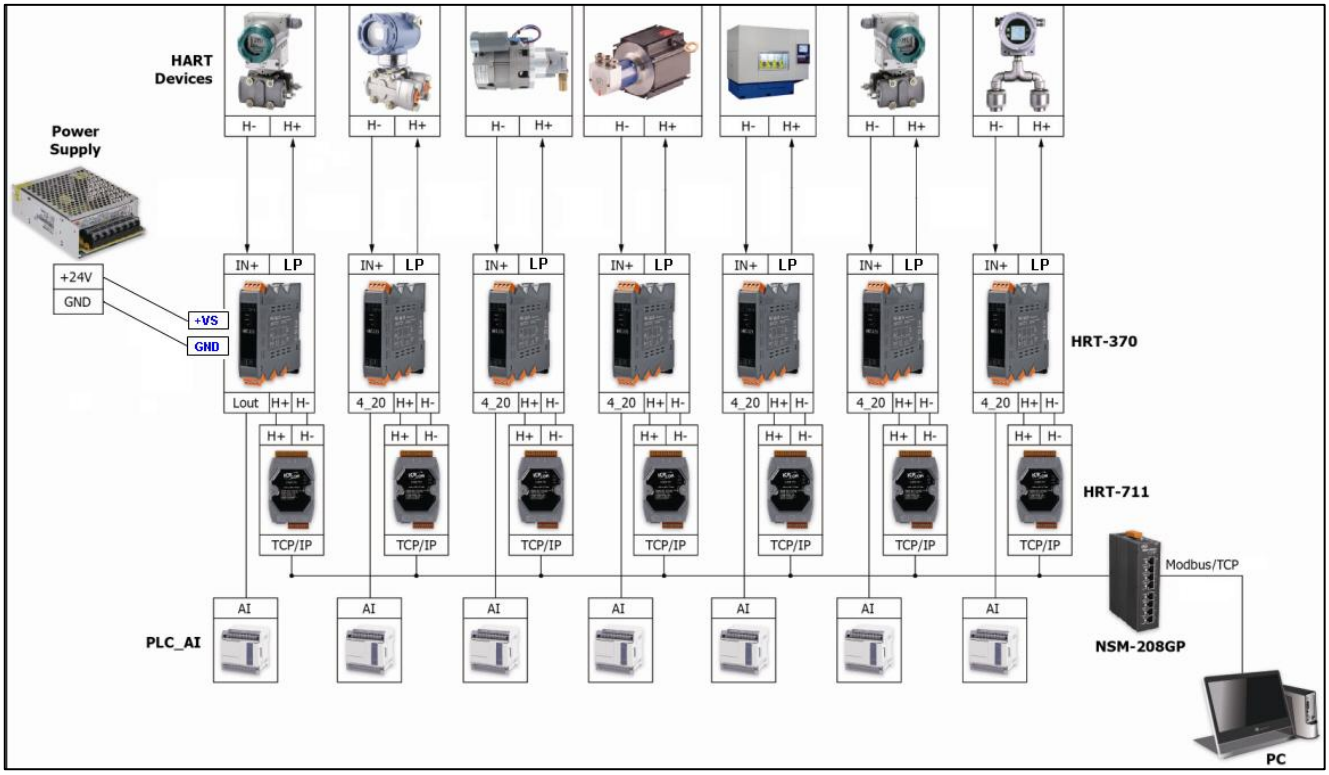


Figure 2.4.7：Case 2 wiring (HART device powered by loop power of HRT-370)

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2.5 LED Indicator

There are 3 LEDs display on the front of HRT-370:

(1) PWR: indicates module power status

(2) HART: indicates communication status of HART

(3) AO: indicates analog output status

The below table listed the description of LEDs status



Figure 2.5: LEDs on HRT-370

[Table 2.5: LED status description]

LED Name	LED Status	LED Description
PWR	ON	Module power supply normally
	OFF	Module power supply failed
HART	ON	HART slave device connected (Loop requires at least 4mA)
	OFF	HART slave device disconnected
AO	ON	Analog output loop connected (Loop requires at least 1mA)
	OFF	Analog output loop disconnected

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3. FAQ

Q01 : HRT-370 functions description when connecting with HDS simulated device

A01: (2018/11/28)

When HRT-370 device-end (In +/-) connecting with simulated HART device (by ICP DAS HART converter (I-7567/I-7547/I-7570)), the following needs to be concerned:

1. **HRT-370 HART function**

   HART master is able to send/receive HART commands which HDS supports via HRT-370

2. **HRT-370 AO function**

   HRT-370 AO-end passes the filtered analog current from HART device, because the HART device simulated by HART converter cannot output actual analog current, therefore HRT-370 AO function is not available in this situation

3. **HRT-370 LED function**

   HRT-370's HART and AO LED are both derived by HART device's analog current output (HART: >4mA; AO: >1mA), because the HART device simulated by HART converter cannot output actual analog current, therefore HRT-370's HART and AO LEDs will be off in this situation. PWR LED remain on when HRT-370 powered properly.

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Appendix A. Revision History

Revision	Author	Date	Description
1.0.3	Edward	2024/03/19	Add the content of “2.4 Wiring” section
1.0.2	Peter	2018/12/17	Two-wired and four wired device wiring
1.0.1	Peter	2018/11/28	1. Add LED ON condition 2. Add FAQ Q01
1.0.0	Peter	2018/03/06	Initial issues

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