



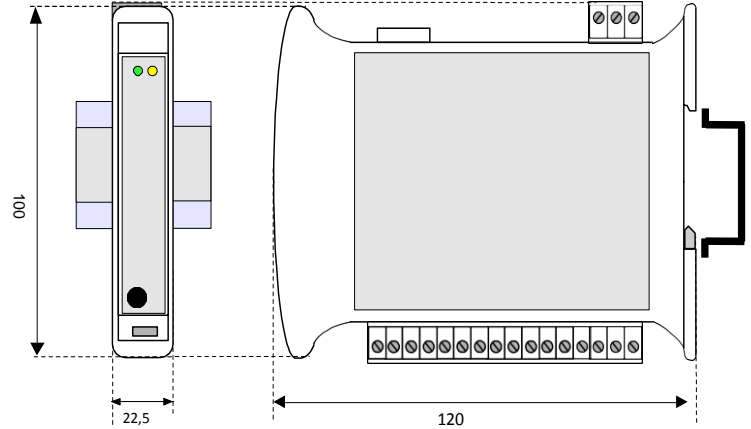
# SmartMod+ Analogue Input Module HE399ADC107 4 Isolated Current and Voltage Input Channels



## 1 Specifications

	Min	Max		
Input Voltage	-10 V	+10 V	Input Imped.	Volt $\geq 1 \text{ M}\Omega$ mA $\sim 22\Omega$
Input Current	-20 mA	+20 mA	Auxiliary Supply Per ch	12 Vcc min@20mA
Input Accuracy	Volt $\pm 0.05\%$ f.s. mA $\pm 0.05\%$ f.s.		Thermal Drift	Full Scale $\pm 0.01\%$ /°C
Linearity	Volt $\pm 0.1\%$ f.s. mA $\pm 0.1\%$ f.s.		Sampling Time (4ch)	150 ms
Relative Humidity	0 to 90% Non-condensing		Mounting	DIN Rail standard EN-50022
Network Interface	Ethernet 10/100 Base-T		Protocol	Modbus TCP
Max Cable Length	100 meters		Number of socket	Up to 16
Operating Temp.	-10° to 60 °C		Storage Temp.	-40 – 85 °C
External Power Supply Voltage	20-30Vdc		Weight	~160g
Short Circuit current auxiliary supply	28 mA		Connections	Ethernet, RJ45, Removable screw-terminals
Reverse Polarity Protection	60 Vdc max		Max. Data Transmission Baud Rate	115.2 Kbps
Isolation	1500 Vac, 50Hz, 1 min		Max. Distance	1200m
Power Consump.	Not operative Aux. – 85 mA tip@24Vdc Not operative Aux. – 100 mA max@20Vdc Operative – 150mA max@24Vdc Operative – 170 mA@20Vdc			
CE Compliance	Immunity EN 61000-6-2 Emission EN 61000-6-4			

## Mechanical Dimensions (mm)



Note: Number of I/O terminal connections varies from model to model

## CONNECTIONS

### Analogue Inputs

**VOLTAGE**

INPUT 1: + Input V (4), - Input GNA0 (2)

INPUT 3: + Input V (8), - Input GNA1 (6)

INPUT 5: + Input V (12), - Input GNA2 (10)

INPUT 7: + Input V (16), - Input GNA3 (14)

**PASSIVE mA INPUT**

INPUT 0: + Input I (1), - Input GNA0 (2)

INPUT 2: + Input I (5), - Input GNA1 (6)

INPUT 4: + Input I (9), - Input GNA2 (10)

INPUT 6: + Input I (13), - Input GNA3 (14)

**ACTIVE mA INPUT**

INPUT 0: mA TX (3), Input I (1), Aux supply (+) (7), Aux supply (-) (11)

INPUT 2: mA TX (7), Input I (5), Aux supply (+) (11), Aux supply (-) (15)

INPUT 4: mA TX (11), Input I (9), Aux supply (+) (15), Aux supply (-) (19)

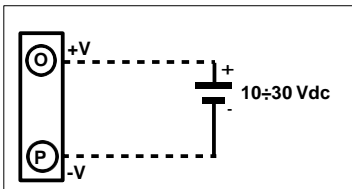
INPUT 6: mA TX (15), Input I (13), Aux supply (+) (19), Aux supply (-) (23)

**NOTES:**  
"GNA0", "GNA1", "GNA2" and "GNA3" are isolated between them.

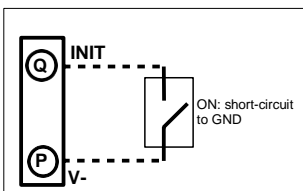
Input Voltage 1 and Input current 0 belong to channel 0 (CH0)  
Input Voltage 3 and Input current 2 belong to channel 1 (CH1)  
Input Voltage 5 and Input current 4 belong to channel 2 (CH2)  
Input Voltage 7 and Input current 6 belong to channel 3 (CH3)

## 2 Connections

### Power Supply



### INIT



### 3 Communication Protocols

The module is designed to work with the MODBUS TCP/IP protocol. The Ethernet interface allows the values of the modules internal registers to be written and read in real time, and allows the direct interface of HE399 series modules to all Horner Ethernet based X-Series controllers.

### 4 User Instructions

Before installing this module, please read the **Installation Instructions** section carefully. To configure the module using the INIT mode: Connect the terminal INIT to the terminal -V, at power-on the module will automatically set to the configuration set-up. Connect the power supply, serial bus, inputs and outputs as shown in the **Wiring** section. The LEDs state depends on the working condition of the module, see the **LED Indicator** section to verify the modules working state. To perform configuration and calibration operations, read the instructions below.

To simplify handling or replacing the module, it is possible to remove the wired terminals when the module is powered on.

### 5 Installation Instructions

Attach the HE399ADC107 to DIN rails in the vertical position. For optimum operation follow these instructions:

**When the modules are installed side by side and** - If the panel temperature exceeds 45°C and power supply voltage is 10 VDC - **it may be necessary to separate them by >5 mm:**

Make sure that there is sufficient air flow around the module, avoid placing near cable routing or other objects that can obstruct the ventilation slits. Additionally, avoid mounting modules above appliances that generate heat. Ideally, they should be placed in the lower part of the panel. Install the module in a location without vibration.

It is also recommended to avoid routing conductors near power signal cables (motors, induction ovens, inverters etc...) and to use shielded cables for connecting signals.

### 6 LED Indicator

LED	COLOUR	STATE	DESCRIPTION
PWR	GREEN	ON	Device powered
		OFF	Device not powered
		BLINK	Watchdog alarm
STS	YELLOW	OFF	Device in RUN mode
		BLINK	Device in INIT mode

The LED's are located on the front of the model.

### 7 User Guide – MODBUS TCP/IP

All of the data shared by a module communicating via Modbus TCP/IP protocol are mapped in tables at defined addresses.

Each data can be of two types:

- "REGISTER", 2 bytes (word of 16 bits) that can be associated with analogue input or output, variables, set-point, etc...
- "COIL", 1 single bit that can be associated with digital input or output or to a logic state.

A register can contain the image (mirror) of more coils; for example, each of the 16 digital inputs of a module can be read or written as a single bit by addressing the coil related to each input. Alternatively, the 16 bits can be read or written as a single word addressing the associated register where each bit corresponds to a coil. In the Modbus protocol, registers and coils are divided as per the following groups of addresses:

0xxxx and 1xxxx = Coils (bit)

3xxxx and 4xxxx = Registers (word)

When read and write functions are performed, use the tables indicated below to address the registers. It is possible to access the internal registers of the module by direct command Modbus TCP/IP or by the integrated web server.

### 8 Supported Modbus Function Codes

Function	Description
01	Read Coil Status (0xxxx)
02	Read Inputs Status (1xxxx)
03	Read Holding Registers (4xxxx)
04	Read Inputs Registers (3xxxx)
05	Force Single Coil
06	Preset Single Register
15 (0F)	Force Multiple Coil
16 (10)	Preset Multiple Registers

### 9 Coil Table

(*)Coil (Hex)	(*)Coil (Dec)	Description	Access
0x0092	00146	Watch-dog Enable	R/W
0x0093	00147	Watch-dog Event	R/W
0x0094	00148	Power-Up Event	R/W

#### NOTES:

For HE399 series modules, the group of data 0xxxx is the mirror of the group 1xxxx, the group of data 3xxxx is the mirror of the group 4xxxx, therefore the first register could be addressed either as 30002 (with function 04) or 40002 (with function 03).

The maximum number of coils that can be read through Modbus functions 01 and 02 is **128**. The maximum number of registers that can be read through Modbus functions 03 and 04 is **64**. The maximum number of registers that can be written by Modbus function 16 is **64**. The maximum number of coils that can be written by Modbus function 15 is **64**. See **Supported Modbus Functions Codes** above.

### 10 Register Table

Register Position	Description	Access
40002	Firmware [0]	RO
40003	Firmware [1]	RO
40004	Name [0]	R/W
40005	Name [1]	R/W
40007	Node ID	R/W
40011	System Flags	R/W
40013	Watchdog timer	R/W
40031	Input type Ch (1-0)	R/W
40032	Input type Ch (3-2)	R/W
40033	Input type Ch (5-4)	R/W
40034	Input type Ch (7-6)	R/W
40036	Break status	RO
40041	Analog Input (0) - mA	RO
40042	Analog Input (1) - V	RO
40043	Analog Input (2) - mA	RO
40044	Analog Input (3) - V	RO
40045	Analog Input (4) - mA	RO
40046	Analog Input (5) - V	RO
40047	Analog Input (6) - mA	RO
40048	Analog Input (7) - V	RO

### 11 Description Modbus Registers

#### **40002 / 40003: FIRMWARE**

Field of 2 read only registers; contains the firmware identifier provided by the manufacturer.

#### **40004 / 40005: NAME**

Field of 2 read/write registers (4 bytes or 4 ASCII characters) available for the user, it can contain the name of the module or an abbreviation that identifies its function inside the plant. Each one of the 4 bytes can be written by values from 0 to 255, ASCII characters included.

The default value of this field contains the identifier of the module expressed in ASCII characters.

-Default value: "9002" (ASCII).

**40007: NODE ID**

Contains the MODBUS address of the module, the decimal values allowed are from 1 to 255. This data is necessary for the correct addressing of the module into the Modbus net and must follow the IP address.

Default value: Dec: 1, Hex: 01 INIT: Dec 245, Hex: F5.

**40011: SYSTEM FLAGS**

Contains the enable bits and system events of the device. The following parameters are configurable:

**WATCHDOG ENABLE (161)**

This bit allows the enabling/disabling of the Watchdog Event

0 = Watchdog disabled  
1 = Watchdog enabled

If this bit is active and the module doesn't receive commands for the time specified in the register 40013 **Watchdog Timer** the outputs of the device will be forced as a function of the settings of the register 40011 section "Safe". The Watchdog condition is signaled by the blinking PWR LED.

If this function is required it must be implemented at power-up of the module, the bit must be reset manually when the Watchdog event has occurred.

**WATCHDOG EVENT (162)**

If this bit is set to 1, this indicates that the Watchdog condition has happened

0 = Normal condition  
1 = alarm condition

**POWER-UP EVENT (163)**

This bit is forced to 1 each time the module is powered-on and indicates that the module has been switched off or reset. By setting this bit to 0 and checking its state it is possible to monitor if a reset of the module has occurred.

0 = reset not occurred  
1 = reset occurred.

Bit	15-13	12	11	10	9	8	7	6	5-0
Set	-	-	-	163	162	161	-	-	-

**40013: WATCHDOG TIMER**

Contains the value of the WatchDog timer, expressed in intervals of 1 second.

If the WatchDog is enabled and the module doesn't receive commands in a time lower or equal to the value of the one expressed in this register the WatchDog will be activated (see description register **System Flags**).

-Default value: 10 (10 sec.)

**40031: INPUT TYPE Ch 0**

This register shows the input types that have been configured (see **Input Type Table**). In this module, the configuration of the input types is fixed:

**Input # 1 → Volt**

**Input # 0 → mA**

To disable input simply write 0 to the part relating to the input that you want to disable.

- Default: (0203 Hex)

Bit	15-08	07-00
Descr.	Input Type #1	Input Type #0

**40032: INPUT TYPE Ch 1**

This register shows the input types that have been configured (see **Input Type Table**). In this module, the configuration of the input types is fixed:

**Input # 3 → Volt**

**Input # 2 → mA**

To disable input simply write 0 to the part relating to the input that you want to disable.

- Default: (0203 Hex)

Bit	15-08	07-00
Descr.	Input Type #3	Input Type #2

**40033: INPUT TYPE Ch 2**

This register shows the input types that have been configured (see **Input Type Table**). In this module, the configuration of the input types is fixed:

**Input # 5 → Volt**

**Input # 4 → mA**

To disable input simply write 0 to the part relating to the input that you want to disable.

- Default: (0203 Hex)

Bit	15-08	07-00
Descr.	Input Type #5	Input Type #4

**40034: INPUT TYPE Ch 3**

This register shows the input types that have been configured (see **Input Type Table**). In this module, the configuration of the input types is fixed:

**Input # 7 → Volt**

**Input # 6 → mA**

To disable input simply write 0 to the part relating to the input that you want to disable.

- Default: (0203 Hex)

Bit	15-08	07-00
Descr.	Input Type #7	Input Type #6

**Table Input Type**

Input	Value (Hex)	Value (Dec)
Disabled	00h	0
Volt	02h	2
mA	03h	3

**40041 : ANALOGUE INPUT #0 (mA)**

**40042 : ANALOGUE INPUT #1 (V)**

**40043 : ANALOGUE INPUT #2 (mA)**

**40044 : ANALOGUE INPUT #3 (V)**

**40045 : ANALOGUE INPUT #4 (mA)**

**40046 : ANALOGUE INPUT #5 (V)**

**40047 : ANALOGUE INPUT #6 (mA)**

**40048 : ANALOGUE INPUT #7 (V)**

These registers return the value of each channel, converted to engineering units. The values are expressed in mV or  $\mu$ A.

- 20000 → 20mA
- 10000 → 10V
- 20000 → -20mA
- 10000 → -10V

The format is a signed 16-bit integer.

**12 Procedure**

**USE OF THE FUNCTION "INIT" (\*)**

All HE399 series modules are equipped with INIT mode. This procedure allows access to the module through the default parameters in order to proceed with its configuration:

IP Address: XXX.XXX.XXX.XXX (assigned by DHCP if enabled) 192.168.1.174 (DHCP disabled, indicates that the IP is not in use) Modbus address: 245  
Using these parameters, it is possible to access the module in INIT modality to set and check the configuration.

To work in INIT use the following procedure:

- Switch-off the module.
- Connect the terminal INIT to terminal -V.
- Power-on the module.
- Connect to the module using of the default parameters above.
- When the user is finished working in INIT.
- Switch-off the module.
- Disconnect INIT.
- Power-on the module and connect to it using the known parameters or by those set in INIT mode.

**WATCHDOG**

The HE399 series is equipped with a Watchdog timer, if enabled, activates an alarm each time that communication is lost between the module and the master for a period time greater than the programmed one. In the alarm condition the values of the outputs are automatically set as defined in the register. **PowerUp/Safe**, this is the condition to which the outputs must be set to avoid damage to the system in the case of a fault occurring. The value set cannot be the same as the value of the outputs before the reset. After the reset a command has to be resent to set the output port.

During this alarm condition the green LED on the front of the device blinks and the **Watchdog Event** coil is forced to 1. To exit from the alarm condition reset the **Watchdog Event** coil, the LED will stop blinking and it will be possible to command the outputs.

**FUNCTION BUTTON "P"**

To restore the default parameters of the module, with the module powered on and not in the INIT condition, push and hold button "P", located on the front, for at least 5 seconds.

The green PWR LED will switch-off, the yellow STS LED will become orange, and the module will reset.

When the reset has finished, both the LEDs will return to the default condition and the following parameters will be loaded:

**Ethernet:**

- IP Address: 192.168.1.100  
 - Subnet Mask: 255.255.255.0  
 - Gateway Mask: 192.168.1.1

**Username:** Fact\_user

**Password:** Fact\_pwd

**Modbus:**

Address: 1

**13 Installation / safety**

**Warning:** Remove power from the OCS controller, CAN port, and any peripheral equipment connected to this local system before adding or replacing this or any module.

- All applicable codes and standards should be followed in the installation of this product.
- Shielded, twisted-pair wiring should be used for best performance.
- Shields may be terminated at the module terminal strip.
- In severe applications, shields should be tied directly to the ground block within the panel.
- Use the following wire type or equivalent: Belden 8441.

For detailed installation and a handy checklist that covers panel box layout requirements and minimum clearances, refer to the hardware manual of the controller you are using.

When found on the product, the following symbols specify:



**Warning:** Electrical Shock Hazard.



**Warning:** Consult user documentation.

**14 Technical support**

Technical Support at the following locations:

**North America:**

Tel: 317 916-4274  
 Fax: 317 639-4279  
 Web: [www.hornerautomation.com](http://www.hornerautomation.com)  
 Email: [techsppt@heapg.com](mailto:techsppt@heapg.com)

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 Fax: +353-21-4321826  
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