



SMARTMOD DATASHEET

HE359ADC120 / HE359ADC220 20mA Analog Input Module - 16-Bit Resolution

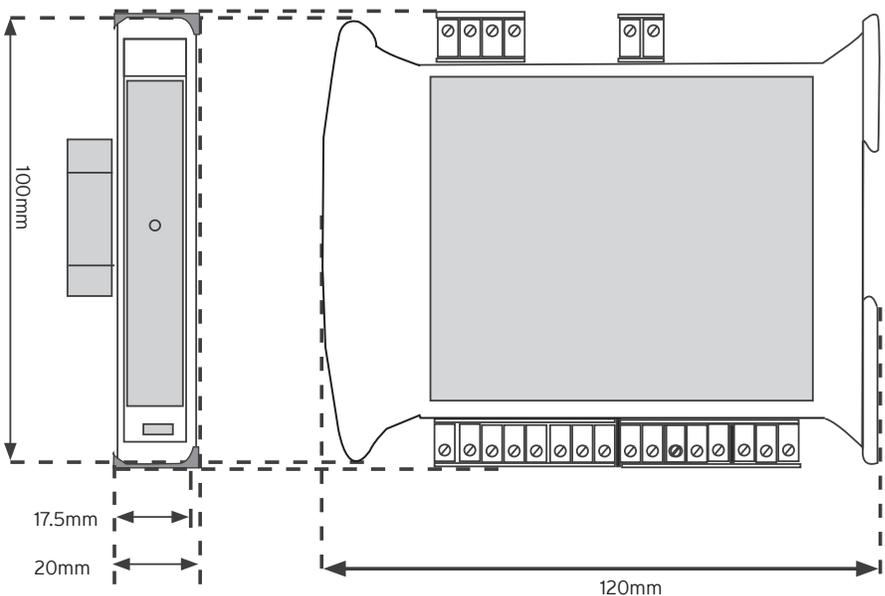
1 TECHNICAL SPECIFICATIONS

SPECIFICATIONS			
	ADC120	ADC220	
Number of Channels	4	8	Terminal Type
Input Ranges	+/- 20mA		Screw Type, Removable
Resolution	Approximately 16-Bit		Storage Temperature
Input Impedance	< 50Ω		-40°C to 85°C
Linearity	+/- 0.1%		Operating Temperature
External Power Supply Voltage	10 - 30VDC		-10°C to 60°C
Required Power (Steady State)	30mA @ 24VDC, typical		Relative Humidity
Isolation	2000VAC 50Hz, 1 min.		5 to 95% Non-condensing
Required Power (Inrush)	Negligible		Dimensions W x H x D
Isolation	2000VAC for 1 min. (Input/Power & Input/Comms)		17.5mm x 100mm x 120mm (0.69" x 3.94" x 4.72")
Conversion Time (PLC Update Rate)	Determined by Communications w/OCS		Weight
			150g (6 oz.)
			Communications
			Modbus/RTU (binary) RS-485 half duplex
			Factory Default Communications Parameters
			38400 Bd, N, 8, 1, no h/s Default Modbus ID 1
			Supported Modbus Commands
			1, 2, 3, 4, 5, 6, 8, 15, 16
			Certifications (CE)
			USA: https://hornerautomation.com/certifications/ Europe: www.hornerautomation.eu

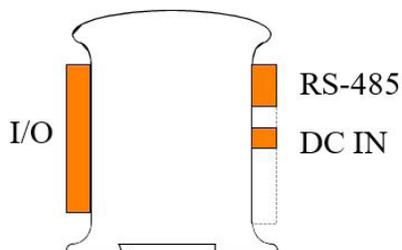
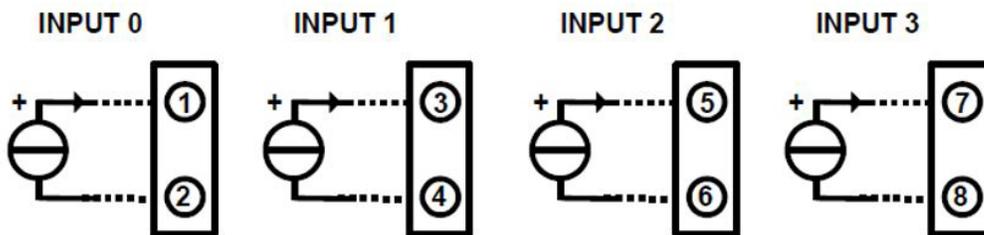
2 DIMENSIONS

Dimensions in inches:
.69" W x 3.94" H x 4.72" D

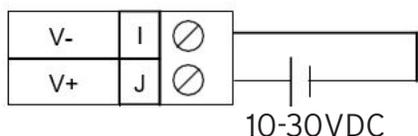
Note: Number of I/O terminal connections varies from model to model.



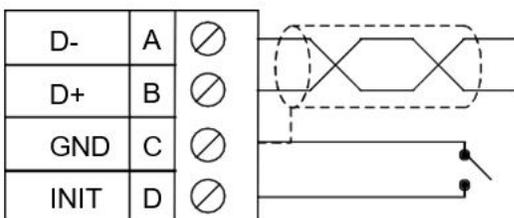
3 WIRING - I/O



Wiring DC IN



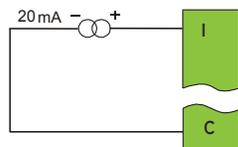
Wiring RS-485



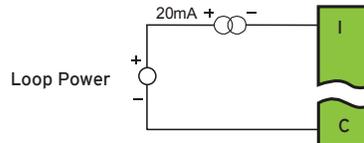
Pin #	ADC120	ADC220
1	INPUT 0+	INPUT 0+
2	ANALOG COMMON	ANALOG COMMON
3	INPUT 1+	INPUT 1+
4	ANALOG COMMON	ANALOG COMMON
5	INPUT 2+	INPUT 2+
6	ANALOG COMMON	ANALOG COMMON
7	INPUT 3+	INPUT 3+
8	ANALOG COMMON	ANALOG COMMON
9		INPUT 4+
10		ANALOG COMMON
11	Only Terminals 120 through 8 are present on the ADC120 model.	INPUT 5+
12		ANALOG COMMON
13		INPUT 6+
14		ANALOG COMMON
15		INPUT 7+
16		ANALOG COMMON

NOTE: Both ends of the RS-485 network should be terminated with a 100Ω, 1/4 W, 1% resistor. Many OCS controllers feature dip switches or jumpers which enable appropriate termination. This should be enabled if the OCS is located on a network end.

20mA Analog In - Self Powered



20mA Analog In - Not Self Powered



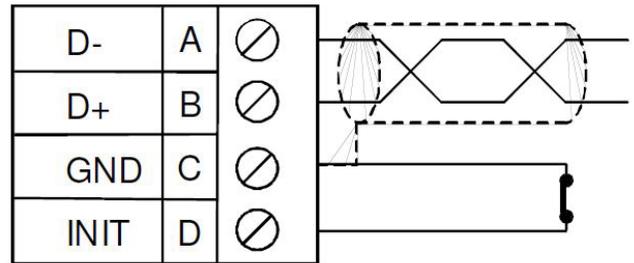
4 INIT DEFAULT SETUP

Communication parameters will be set in INIT default after performing the following procedure:

1. Install jumper between INIT and GND terminals of RS-485.
2. Apply power to SmartMod unit.
3. Read parameter words to see current parameters.
4. Write changes if necessary.

The Default settings are:

Modbus ID = 1
 Baud rate = 9600
 Parity = None
 Stop Bits = 1
 Data Bits = 8
 No handshake*



- NOTE:** There are two types of default settings:
1. Factory as described in Section 1 (Specifications)
 2. Default after INIT (INIT Default Setup)

*If using downloadable Modbus protocol in Cscape, select Multi-drop Half setting for handshake.

5 CONFIGURATION DATA

SmartMod Configuration settings are mapped into Modbus Register space. This configuration data may be modified with any Modbus/RTU Master device. For convenience, Horner has developed a variety of Cscape application files which allow an OCS to act as a SmartMod configuration device. Initial configuration of SmartMod module should be done on an individual basis, since all modules come from the factory with a default Modbus ID of 1. Once each module on the network has its own unique Modbus ID, further configuration adjustments can be made with the entire network powered.

All configuration parameters listed below (except 40012 Channel Enable) are stored in EPROM. This means they should not be constantly rewritten.

Configuration Parameters - Registers 40001 through 40014

Modbus Register	Description	Min	Max	Default
40001 - 40005	Reserved			
40006	Communications Parameters	See Table		38.4 kBd, N, 8, 1, RTU Mode
40007	Modbus ID	1	255	1
40008	Rx/Tx Delay (in 2ms steps)	0	255	1ms
40009	Watchdog Timer (in 0.5s steps)	0	255	10 (5s)
40010	Modbus Coil Data	No Configuration Data - See I/O Data		
40011	Input Type	6	6	6 (+/-10V)
40012	Channel Enable	See Table		255 (Channels 1-8 enabled)
40013	Reserved			
40014	Reserved			

configuration data continued...

Register 40006 (Communications Parameters) Bit Definition							
Bits 7-15	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Unused	Mode	Parity		Data Bits	Baud Rate		
	0 = ASCII Mode	Value	Meaning	0 = 7 Data Bits	Value	Meaning	
		0	Mark		0	1200Bd	
		1	Even		1	2400Bd	
	1 = RTU Mode	2	Odd	1 = 8 Data Bits	2	4800Bd	
		3	Space		3	9600Bd	
					4	19200Bd	
					5-7	38400Bd	

NOTE: Data bits number is ignored. In ASCII mode it is fixed at 7 and in RTU mode it is fixed to 8. In RTU model the parity bit is ignored (parity is fixed at NONE).

Registers 40010 (Mirror of Coil Data) Bit Definition			
Bit 3-15	Bit 2	Bit 1	Bit 0
Unused	Power-up Event (Coil 11)	Watchdog Event (Coil 10)	Watchdog Event (Coil 9)
	0 = Disable Input		
	1 = Enable Input		

Register 40012 (Channel Enable) Bit Definitions								
Bit 8-15	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Unused	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0
	0 = Disable Input							
	1 = Enable Input							

6 INPUT / OUTPUT DATA

SmartMod Analog I/O utilizes both Modbus Registers (40001-40030) and Coils (1-11). It is possible to access all data using Registers only because the Coils can be accessed through register 40010.

I/O Register Data (Registers 40014 - 40022)					
Modbus Register	Description	Access	Minimum	Maximum	Units
40010	Mirror of Coil Data	Read/Write	n/a	n/a	n/a
40015	Input 0	Read - only	0	20000	1 μ A
40016	Input 1	Read - only	0	20000	1 μ A
40017	Input 2	Read - only	0	20000	1 μ A
40018	Input 3	Read - only	0	20000	1 μ A
40019	Input 4	Read - only	0	20000	1 μ A
40020	Input 5	Read - only	0	20000	1 μ A
40021	Input 6	Read - only	0	20000	1 μ A
40022	Input 7	Read - only	0	20000	1 μ A

7 IMPLEMENTED MODBUS FUNCTIONS

Modbus Functions			
Function	Code	Function	Code
01	Read multiple coils (0xxxx bank)	06	Write single register
02	Read multiple coils (1xxxx bank)	15	Write multiple coils
03	Read multiple registers (4xxxx bank)	16	Write multiple registers
04	Read multiple registers (3xxxx bank)	08	Diagnostic
05	Write single coil		

For ADC120/220 SmartMod modules, bank 0xxxx is a mirror of bank 1xxxx, as 3xxxx is a mirror of 4xxxx, i.e. the first register can be read independently as 30001 (with the function 04) or 40001 (with the function 03).

8 WATCHDOG

The module has been provided with a Host Watchdog timer which, when it is enabled, issues an alarm event each time the communication between the module and the host is inactive for a period time greater than the programmed one (40009). When the alarm is activated, the values of the outputs are automatically converted to the values set as 'safety value', that corresponding to the state in which the outputs must be placed, and therefore the actuators are putted, to avoid damages to the system in case of failure. Moreover, under the alarm condition the green LED on the front of the module blinks and the "Watchdog Event" coil is forced to a value of 1.

To return from the alarm condition, reset the coil "Watchdog Event" coil: the LED stop blinking and it is possible to set the outputs once again

There is also a Module Watchdog timer that monitor the internal CPU work and is active when the CPU doesn't function correctly for any reason, and resets the module. After the reset, all outputs will assume their initial default value ("power up value"), This may be different to the output value after the reset. (Table on following page.)

watchdog continued...

Register 40009 Definition		
The Watchdog Timeout value is set in Modbus register 40009 (Resolution of 0.5s)		
Coil 00009	Coil 00010	Coil 00011
Watchdog Enabled	Watchdog Event	Power-up Event
0 = Input Disabled		
1 = Input Enabled		
If Coil 9 (Watchdog Enabled) is set, Coil 10 (Watchdog Event) will set if the Watchdog Timeout value is exceeded.		
When set, Coil 10 can be reset by the controller when normal communications resumes.		
The Power-up Event (Coil 11) is set every time the power is applied. It can be cleared by the controller if desired.		

9 SYNC

SYNC			
Register	Function	Register	Function
40023	SYNC INPUT VALUE #0	40027	SYNC INPUT VALUE #4
40024	SYNC INPUT VALUE #1	40028	SYNC INPUT VALUE #5
40025	SYNC INPUT VALUE #2	40029	SYNC INPUT VALUE #6
40026	SYNC INPUT VALUE #3	40030	SYNC INPUT VALUE #7

The Sync function is performed by a command sent to all devices connected on the network. When the devices receive the Sync command, all Input states are saved in the relative register. Doing this, it is possible to read the value of all inputs at the Sync command time.

To send the Sync command, write the value 10 in the "Test" register (40001) and send to node ID 255.

NOTE: The sync values are not saved in EPROM.

When the device receives the Sync command, the actual input values in the 40015-40022 registers are saved in registers 40023-40030, channel by channel, as outlined above. These values will be stored until the next sync command, to be read at a following time.

10 CALIBRATION

The calibration procedure is performed in factory, on all the modules during the testing phase. However it can be convenient to make another calibration of the module according to the requirements of the user. To do a calibration, it is necessary to use precision instruments and to correctly perform all the steps below. Any error made in the calibration procedure reduces the accuracy and the good operation of the device.

NOTE: For the RTDs, the device uses the calibration of 0-500Ω or 0-2000Ω input type.

To re-calibrate the device, follow this procedure:

- 1 - Turn on the device in INIT condition
- 2 - Connect a calibrator to the channel #0.
- 3 - Program the input type to be calibrated
- 4 - Set the calibrator at 0V or 0mA
- 5 - Write on the "Test" register (40001) the value 20.
- 6 - Set the calibrator to the full-scale value (10V or 20mA)
- 7 - Write on the "Test" register (40001) the value 30.
- 8 - Repeat point 3 to 7 for each input type to be calibrated.

11 LED INDICATORS

LED Indicators			
LED	Color	State	Meaning
POWER	Green	ON	Device Powered
		OFF	Device Not Powered / Incorrect RS485 Cabling
		Fast Blink	Communication in progress (blink frequency depends on baud rate)
		1 Second Blink	Watchdog Alarm Condition (See Section 8)

The LED is located on the front of the model.

12 INSTALLATION AND SAFETY

INSTALLATION & UL INSTRUCTIONS

- All applicable codes and standards should be followed in the installation of this product.
- Shielded, twisted-pair wiring should be used for best performance.
- 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 that covers panel box layout requirements and minimum clearances, refer to User Manual of controller.

For UL installation, the device must be power using a power supply unit classified NEC Class 2 SELV.

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

ATTENTION - RISQUE D'EXPLOSION - NE DÉBRANCHEZ PAS L'ÉQUIPEMENT SAUF SI L'ALIMENTATION A ÉTÉ COUPÉE OU SI LA ZONE N'EST PAS DANGEREUSE.

WARNING: Electrical Shock Hazard.

Device shall be installed into an enclosure that is only accessible with the use of a tool.

INSTALLATION PROCEDURE

- The SmartMod modules conveniently mount on a DIN rail.
- Be sure the DIN rail is in a horizontal position before installing the unit.
- The orientation shown to the right is necessary to prevent the unit from slipping off the DIN rail.
- Align the unit on the DIN rail then push the DIN rail clip until it clicks into place. Check to ensure that the unit is secure on the DIN rail.
- Do NOT mount the unit on its side as this may cause the unit from slipping off the DIN rail.

WARNINGS

- To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
- To reduce the risk of fire, electrical shock, or physical injury, it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.
- Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.
- In the event of repeated failure, do NOT replace the fuse again as repeated failure indicates a defective condition that will NOT clear by replacing the fuse.
- Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

FCC COMPLIANCE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation

PRECAUTIONS

All applicable codes and standards need to be followed in the installation of this product. Adhere to the following safety precautions whenever any type of connection is made to the module:

- Connect the safety (earth) ground on the power connector first before making any other connections.
- When connecting to the electric circuits or pulse-initiating equipment, open their related breakers.
- Do NOT make connection to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals.
- Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.
- Use copper conductors in Field Wiring only, 60/75°C.

13 PART NUMBERS

The global part numbers are HE359ADC120 or HE359ADC220.

14 TECHNICAL SUPPORT

For assistance and datasheet updates, contact Technical Support at the following locations:

North America
+1 (317) 916-4274
www.hornerautomation.com
techsppt@heapg.com

Europe
+353 (21) 4321-266
www.hornerautomation.eu
technical.support@horner-appg.com