



SmartMod Analog Output Module

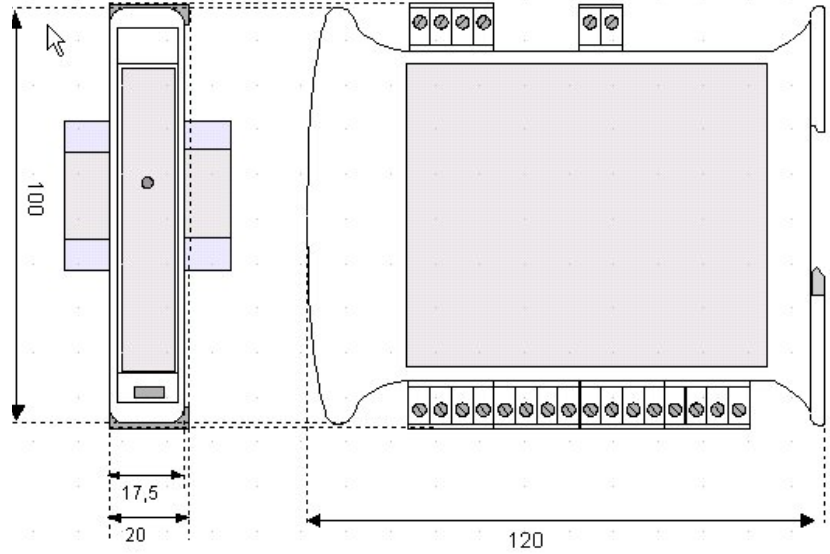
HE359DAC007 / HE359DAC107

Selectable 0-20mA or 0-10V 1 μ A or 1 mV Resolution

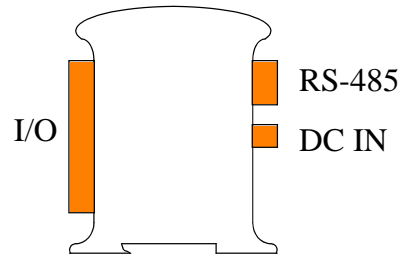


1 Specifications

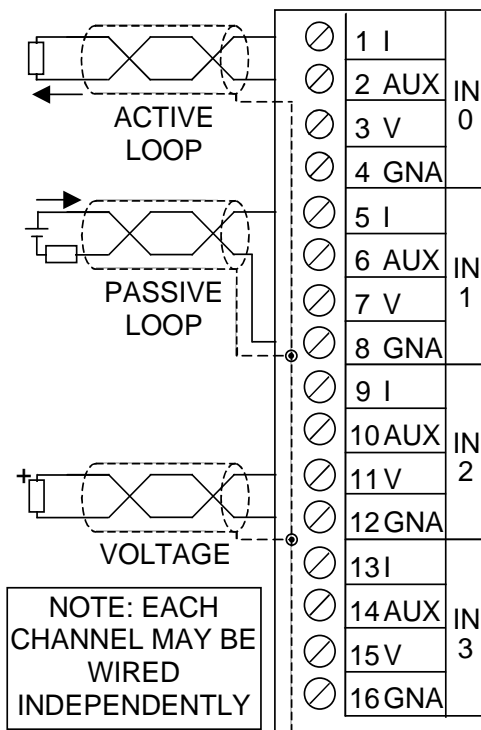
	DAC007	DAC107		DAC007	DAC107
Number of Channels	2	4	Auxiliary Voltage	12V @ 20mA (4 channels)	
Output Ranges	0-20mA or 0-10V		Terminal Type	Screw Type, Removable	
Resolution	1 μ A or 1 mV		Storage Temp.	-40° to 85° Celsius	
Load Resistance	Voltage: >5Kohm Current: <500ohm		Operating Temp.	-10° to 60° Celsius	
			Relative Humidity	0 to 90% Non-condensing	
Output Calibration	Voltage: +/-10mV Current: +/-20uA		Dimensions WxHxD	17.5mm x 100mm x 120mm 0.69" x 3.94" x 4.72"	
External Power Supply Voltage	18-30Vdc		Weight	150g (6 oz.)	
Required Power (Steady State)	30mA @ 24Vdc, typical (100mA max)		Communications	Modbus/RTU (binary) RS-485 half duplex	
Required Power (Inrush)	Negligible		Factory Default Communications Parameters	38400 baud, N, 8, 1, no h/s Default Modbus ID 1	
Isolation	2000Vac for 60 seconds (Input/Power & Input/Comms)		Supported Modbus Commands (family)	1,2,3,4,5,6,8,15,16	
CE & UL Compliance	See Compliance Table at http://www.heapg.com/Pages/TechSupport/ProductCert.html				



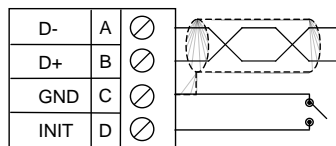
Dimensions are 0.69"W x 3.95"H x 4.72"D
Note: Number of I/O terminal connections varies from model to model



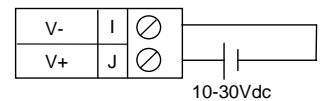
2 Wiring - I/O



Pin #	DAC007	DAC107		Pin #	DAC007	DAC107	
1	I	I	OUT 0	9		I	OUT 2
2	AUX	AUX		10		AUX	
3	V	V		11	Only Terminals 1 through 8 are present on the DAC007 model	V	
4	GNA	GNA		12		GNA	
5	I	I	OUT 1	13		I	OUT 3
6	AUX	AUX		14		AUX	
7	V	V		15		V	
8	GNA	GNA		16		GNA	



Wiring RS-485



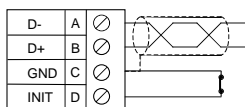
Wiring DC IN

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

3 Init Default Setup

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

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



The INIT Default RS485 Settings Are:

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

Note: There are 2 types of default settings possible:
 1. Factory default as described in section 1 (Specifications)
 2. Default after INIT as described in section 3 (INIT Default Setup)

4 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 APG has developed a variety of Cscape application files which allow an OCS (Xle, NX, LX, QX) 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 constantly be rewritten.

Configuration Parameters – Registers 40001 through 40013				
Modbus Register	Description	Min	Max	Default
40001-40005	Reserved			
40006	Communications Parameters	See Table		38.4kbaud, N, 8, 1, RTU Mode
40007	Modbus ID(Address)	1	255	1
40008	Rx/Tx Delay (in 2mS steps)	0	255	0mS
40009	Watchdog Timer (in 0.5s steps)	0	255	10 (5s)
40010	Modbus Coil Data	Not Configuration Data – See I/O Data		
40011	Calibration			
40012	Slew Rate Settings (See Tables)			
40013	Reserved			
40014	Output Type	See Table		0 (All Channels Current)

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	0 = ASCII Mode	Value	Meaning	0 = 7 Data Bits	Value	Meaning	
		0	Mark		0	1200 baud	
1 = RTU Mode	1 = RTU Mode	1	Even	1 = 8 Data Bits	1	2400 baud	
		2	Odd		2	4800 baud	
		3	Space		3	9600 baud	
					4	19200 baud	
					5	38400 baud	
					6,7	Not Used	

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 mode the parity bit is ignored (parity is fixed at NONE).

Register 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 Enabled (Coil 9)
	0 = Disable Input		
	1 = Enable Input		

Slew Rate Settings (Register 40012)				
Bit	15 - 12	11 - 08	07 - 04	03 - 00
Desc.	Slr Output #3	Slr Output #2	Slr Output #1	Slr Output #0

Value	V/s	mA/s	Value	V/s	mA/s
00h	Disabled		07h	9.60	19.2
01h	0.15	0.30	08h	19.2	38.4
02h	0.30	0.60	09h	38.4	76.8
03h	0.60	1.20	0Ah	76.8	153
04h	1.20	2.40	0Bh	153	306
05h	2.40	4.80	0Ch	Immediate	
06h	4.80	9.60			

Specify the slew rate / rising time of rising outputs. The value of each output is made of 4 bits, as shown in the table.
 Manufacturer default: 0Ch / Immediate

Register 40014 (Output Type) Bit Definition				
Bit 4-15	Bit 3	Bit 2	Bit 1	Bit 0
Unused	Output 3	Output 2	Output 1	Output 0
	0 = Current (0-20mA)			
	1 = Voltage (0-10V)			

5 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.

The following tables lists all Modbus I/O data available.

I/O Register Data (Registers 40010-40026)					
Modbus Register	Description	Access	Minimum Volt/Amp	Maximum Volt/Amp	Units
40010	Mirror of Coil Data	Read/Write	n/a	n/a	n/a
40015	Output 0	Read/Write	0	10000/20000	1mV/1uA
40016	Output 1	Read/Write	0	10000/20000	1mV/1uA
40017	Output 2	Read/Write	0	10000/20000	1mV/1uA
40018	Output 3	Read/Write	0	10000/20000	1mV/1uA
40019-40022	Reserved				
40023	Default/Safe Value Out 0	Read/Write	0	10000/20000	1mV/1uA
40024	Default/Safe Value Out 1	Read/Write	0	10000/20000	1mV/1uA
40025	Default/Safe Value Out 2	Read/Write	0	10000/20000	1mV/1uA
40026	Default/Safe Value Out 3	Read/Write	0	10000/20000	1mV/1uA

Modbus Coil	Description	Access
00009	Watchdog Enabled	Read/Write
00010	Watchdog Event	Read/Write
00011	Power-up Event	Read/Write

6 Implemented Modbus Functions

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

For DAC007/107 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)

7 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 preset safety values to avoid damage to the system in case of a fault occurring. Also, under the alarm condition the green LED on the front of the module blinks and the "Watchdog Event" coil is forced to 1. There is also a Module Watchdog timer that monitors the internal CPU work and activates when the CPU doesn't function correctly.

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.

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.		

8 POWERUP Register Settings

Register	Function
40023	POWERUP / SAFE OUTPUT VALUE #0
40024	POWERUP / SAFE OUTPUT VALUE #1
40025	POWERUP / SAFE OUTPUT VALUE #2
40026	POWERUP / SAFE OUTPUT VALUE #3

When the device is turned-on and the watchdog alarm is active, the outputs are automatically forced to the value specified in this register.

- Manufacturer default: 0

The values are expressed in mV for the voltage outputs and in uA for the current outputs:

0 = 0 mA 0 = 0 V
 20000 = 20 mA 10000 = 10 V

9 LED Indicator

LED	COLOUR	STATE	DESCRIPTION
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	Watch-dog Alarm Condition (See Section 6 above)

The LED is located on the front of the model.

10 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:



11 Troubleshooting Tips

If not communicating

- Verify that the wiring is correct
 - Pin 1 on the XL series serial ports is RS-485 positive (+) and is connected to positive (+)
 - Pin 2 on the XL series serial ports is RS-485 negative (-) and is connected to negative (-)
- If the ground pin is not being used, verify that only one device on the network is supplying bias. This is set from the system menu on the XL series controllers.
- Tie the INIT pin to GND then power cycle the SmartMod. Then attempt to communicate with it at the default parameters
- If using the INIT settings, verify with an ohm meter that the jumper is shorted to GND. Then try power cycling the SmartMod unit again.

If any I/O seems unresponsive

- Verify the Modbus address that you are polling e.g. 40010 (command of 3, 6, or 16 offset 00009)
- Verify any registers from the device that may affect the I/O. These will vary between modules. For example, enable, type selection or raw value.

12 Technical support

Technical Support at the following locations:

North America:	Europe:
Tel: 317 916-4274	Tel: +353-21-4321266
Fax: 317 639-4279	Fax: +353-21-4321826
Web: http://www.heapg.com	Web: http://www.horner-apg.com
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