



SMARTMOD DATASHEET

HE359DAC201 SmartMod Analog Output Module 0-10V / 14-Bit Resolution

1 TECHNICAL SPECIFICATIONS

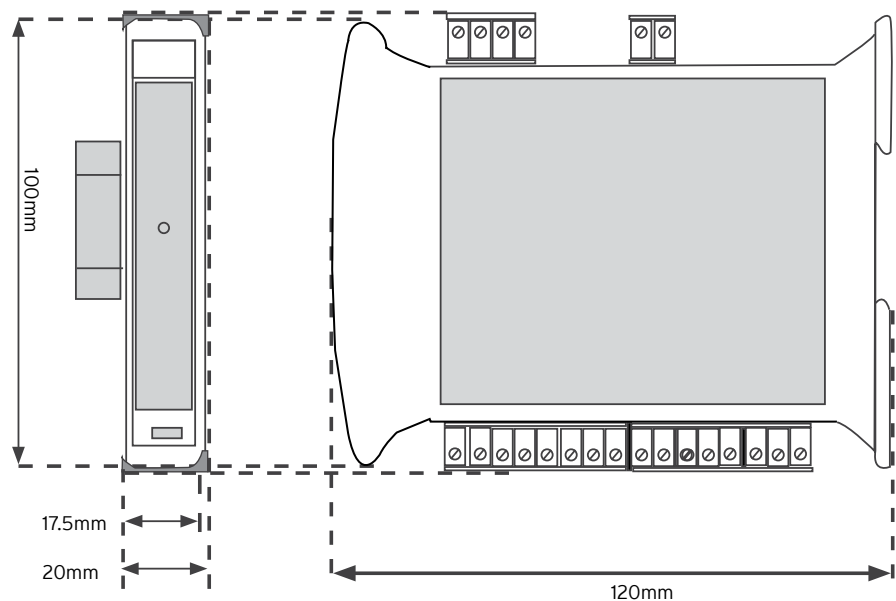
Table 1 - HE359DAC201

Number of Channels	8	Thermal Drift	100 ppm max
Output Ranges	0-10V	Thermal Type	Screw Type, Removable
Resolution	Approximately 14-Bit	Storage Temperature	-40°C to 85°C
Load Resistance	Voltage >5kΩ	Operating Temperature	-10°C to 60°C
Output Calibration	Voltage: +/- 10mV	Relative Humidity	0 to 90% Non-condensing
External Power Supply Voltage	18 to 30VDC	Dimensions (WxHxD)	17.5mm x 100mm x 120mm .69" x 3.94" x 4.72"
Required Power (Steady State)	30mA @ 24VDC, typical	Weight	150g (6 oz.)
		Communications	Modbus/RTU (binary) RS-485 half duplex
Required Power (Inrush)	Negligible	Factory Default Communications Parameters	38400 Bd, 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
Certifications (CE)		USA: https://hornerautomation.com/certifications/ Europe: http://www.horner-apg.com/en/support/certification.aspx	

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

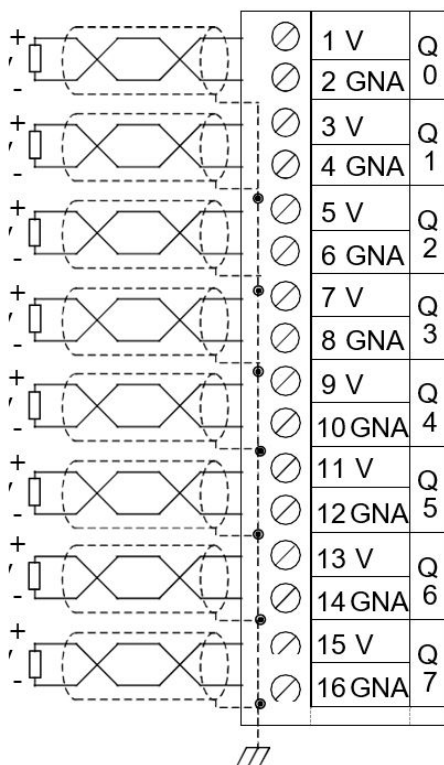
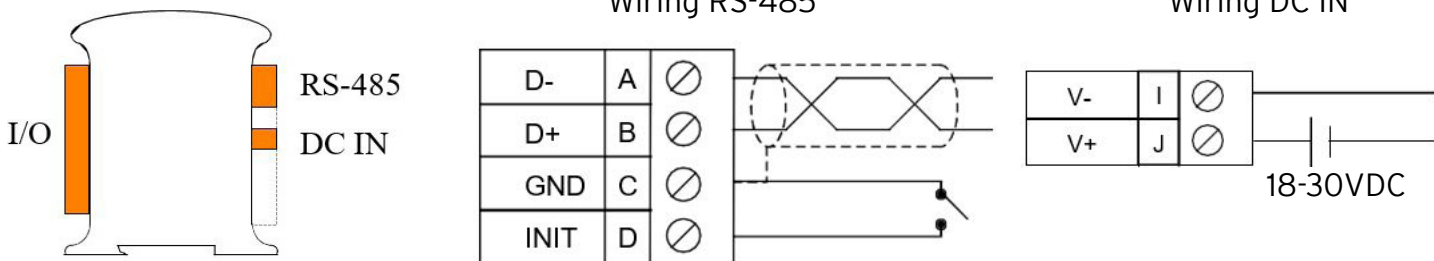


Table 2 - I/O		
Pin #	DAC201	
1	V	
2	GNA	OUT 0
3	V	
4	GNA	OUT 1
5	V	
6	GNA	OUT 2
7	V	
8	GNA	OUT 3
9	V	
10	GNA	OUT 4
11	V	
12	GNA	OUT 5
13	V	
14	GNA	OUT 6
15	V	
16	GNA	OUT 7

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.

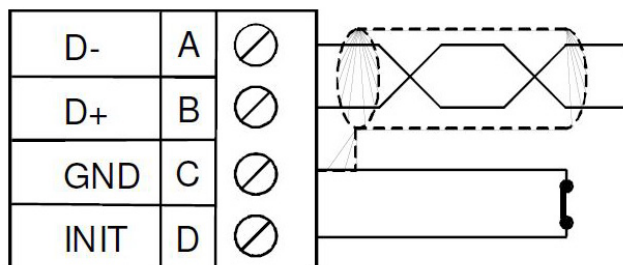
4 INIT DEFAULT SETUP

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)

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.

Table 3 - Configuration Parameters - Registers 40001 through 40014

Modbus Register	Description	Min	Max	Default
40001 - 40005	Reserved			
40006	Communications Parameters	See table below		38.4 kBd, 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	No Configuration Data - See I/O Data		
40011	Reserved			
40012	See Table 6 - Slew Rate Settings			
40013	See Table 6 - Slew Rate Settings			
40014	Output Type	255	255	255 (all channels Voltage)

Table 4 - Registers 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).

configuration data continued...

Table 5 - 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		

Table 6 - Slew Rate Settings (Register 40012/40013)				
	15-12	11-08	07-04	03-00
40012	Slr Output #5	Slr Output #1	Slr Output #4	Slr Output #0
40013	Slr Output #7	Slr Output #3	Slr Output #6	Slr Output #2

Table 7 - Values						
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				

NOTE: 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

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.

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

Table 8 - I/O Register Data (Registers 40010 - 40026)

Modbus Register	Description	Access	Minimum	Maximum	Units
40010	Mirror of Coil Data	Read/Write	n/a	n/a	n/a
40015	Output 0	Read/Write	0	10000	1mV
40016	Output 2	Read/Write	0	10000	1mV
40017	Output 4	Read/Write	0	10000	1mV
40018	Output 6	Read/Write	0	10000	1mV
40019	Output 1	Read/Write	0	10000	1mV
40020	Output 3	Read/Write	0	10000	1mV
40021	Output 5	Read/Write	0	10000	1mV
40022	Output 7	Read/Write	0	10000	1mV
40023	Default/ Safe Value Out 0	Read/Write	0	10000	1mV
40024	Default/ Safe Value Out 1	Read/Write	0	10000	1mV
40025	Default/ Safe Value Out 2	Read/Write	0	10000	1mV
40026	Default/ Safe Value Out 3	Read/Write	0	10000	1mV
40027	Default/ Safe Value Out 4	Read/Write	0	10000	1mV
40028	Default/ Safe Value Out 5	Read/Write	0	10000	1mV
40029	Default/ Safe Value Out 6	Read/Write	0	10000	1mV
40030	Default/ Safe Value Out 7	Read/Write	0	10000	1mV

Table 9 - Modbus Coil

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

7 IMPLEMENTED MODBUS FUNCTIONS

Table 10 - Modbus Functions	
Function	Code
01	Read multiple coils (0xxxx bank or 0 to 9999)
02	Read multiple coils (1xxxx bank or 10000 to 19999)
03	Read multiple registers (4xxxx bank or 40000 to 49999)
04	Read multiple registers (3xxxx bank or 30000 to 39999)
05	Write single coil
06	Write single register
15	Write multiple coils
16	Write multiple registers
08	Diagnostic

For DAC201 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 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 a value of 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.

Table 11 - 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 POWER UP REGISTER SETTINGS

Table 12 - Power Up Registers	
Register	Function
40023	POWERUP / SAFE OUTPUT VALUE #0
40024	POWERUP / SAFE OUTPUT VALUE #4
40025	POWERUP / SAFE OUTPUT VALUE #1
40026	POWERUP / SAFE OUTPUT VALUE #5
40023	POWERUP / SAFE OUTPUT VALUE #2
40024	POWERUP / SAFE OUTPUT VALUE #6
40025	POWERUP / SAFE OUTPUT VALUE #3
40026	POWERUP / SAFE OUTPUT VALUE #7

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 μ A for the current outputs:

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

10 LED INDICATORS

Table 13 - 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 7)

The LED is located on the front of the model.

11 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

1. The SmartMod modules conveniently mount on a DIN rail.
2. Be sure the DIN rail is in a horizontal position before installing the unit.
3. The orientation shown to the right is necessary to prevent the unit from slipping off the DIN rail.
4. 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.
5. Do NOT mount the unit on its side as this may cause the unit from slipping off the DIN rail.

WARNINGS

1. To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.
2. 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.
3. Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.
4. 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.
5. 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:

1. This device may not cause harmful interference
2. 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:

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

12 PART NUMBERS

The global part numbers is HE359DAC201.

13 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

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+353 (21) 4321-266
www.hornerautomation.eu
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