

Micro CPU200/250 Datasheet

MAN1422_01_EN_959CPU200_250_DS



Part Number: HE959CPU200

Part Number: HE959CPU250

User Manual and Add-Ons

Find the documents via the [Documentation Search](#).

Part #	Description
MAN1507	CPU250 User Manual
TBD	3V Lithium Coin Battery
HE-XCK	Programming Cable Kit
HE-FBD001	Ferrite core for filtering out electrical noise
HE200MJ2TRM	Adapter, RJ45 (8P8C) male to 8-position terminal strip

OCS-I/O

Horner OCS-I/O is a remote I/O option that connects using the CsCAN Network to all Horner OCS host controllers. See the Horner [OCS-I/O website](#) for additional information.

Battery Maintenance

The Micro CPU200/250 has an advanced battery system that uses a lithium coin battery. The battery powers the real time clock when power is removed, and it is needed for register data retention. See manual **MAN1507** via the [Documentation Search](#) for more details on battery replacement.

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TECHNICAL SPECIFICATIONS

General Specifications

Required Power (steady state)	630 mA at 24VDC
Required Power (inrush)	35A for 200µs 24VDC switched
Primary Power Range	10-30VDC
Real Time Clock (RTC)	Battery backed; lithium coin cell CR2450
Battery Life	10 years (RTC Support)
Clock Accuracy	± 90 seconds per month
Relative Humidity	5 to 95% non-condensing
Operating Temperature	-40°C to +60°C
Storage Temperature	-40°C to +70°C
Temperature Code	T5
Weight	9.77oz (277.1g)
Mounting	35 mm DIN Rail
Housing Material	Plastic

Control and Logic

Control Language Support	Register -Based Advanced Ladder Logic, Variable-Based Advanced Ladder Logic, IEC 61131-3 Languages.
Logic Program Size	2 MB
Non-Retentive Memory	128kB
Internal Storage Memory	16MB
Total Program Memory	2.5MB
Logic Scan Rate	0.4ms/kB
PID Support	32
%I (Digital Inputs)	2048
%Q (Digital Outputs)	2048
%AI (Analog Inputs)	512
%AQ (Analog Outputs)	512
General Purpose 16-bit Registers (%R) Retentive Registers	50,000
General Purpose 1-bit Registers (%T) Temporary Bits	16,384
General Purpose 1-bit Registers (%M) Retentive Bits	16,384

Connectivity

Serial Ports	1 x RS-232, 1 x RS-485
CAN Port Speeds Support	125kb, 250kb, 500kb, 1Mb/sec.
Ethernet	1 x 10/100Mbps
microSD	SDHC, SDXC in FAT32 format
Communication Support	WebMI, E-mail, TCP/IP, Modbus, FTP, Datalogging
USB Type C Note: Device does not enter run mode when on USB power only	Programming, Power Unit

Testing

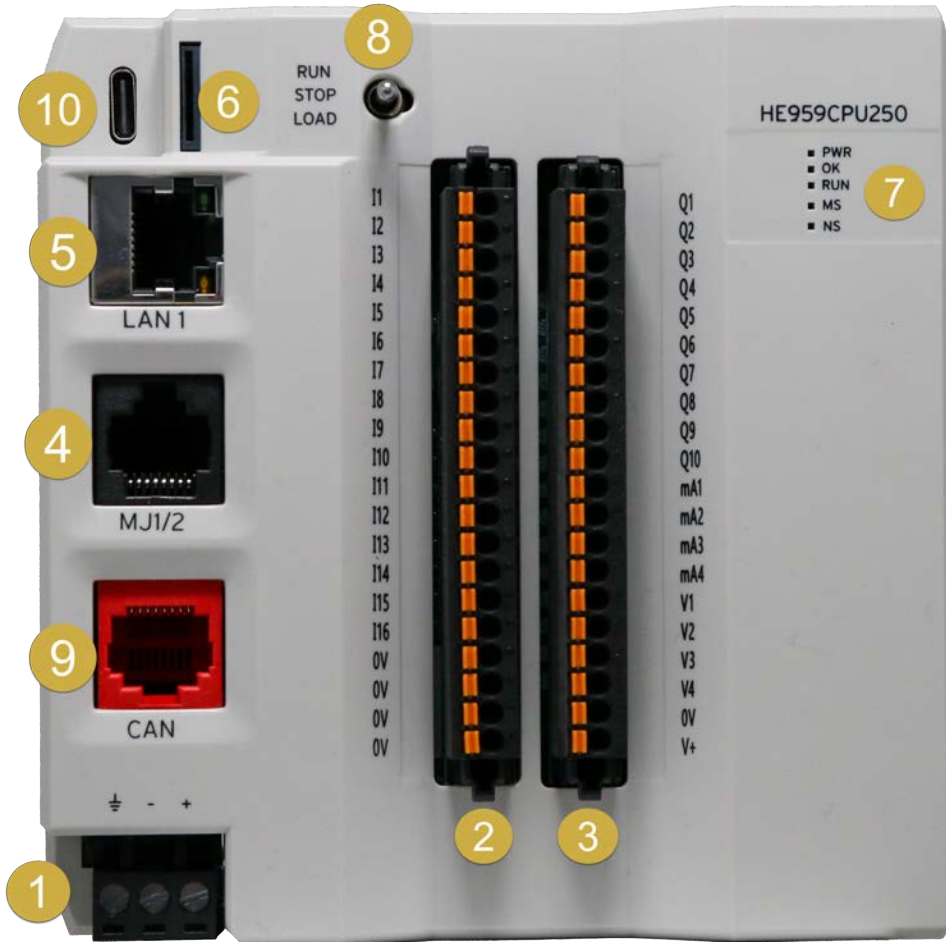
Shock	IEC 60068-2-27
Vibration	IEC 60068-2-6
UL Environmental Ratings	IP20
Certifications (UL/CE)	North America Europe

USB Webcams

USB Webcams supported should support the UVC (USB Video class) protocol for the OCS to be able to display video. Most USB based video devices support this today. Special feature such as zoom and high definition are not supported by the OCS.

CONTROLLER OVERVIEW

Overview of CPU250



1. Power
2. Digital & Flexible In (CPU250 Only)
3. Digital Out & Analog Out (CPU250 Only)
4. Serial Port
5. Ethernet Port
6. microSD Port
7. Status LEDs
8. Mode Switch
9. CAN Port
10. USB Type C Port

Power Wiring

NOTE: The Primary Power Range is 10-30VDC.



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Primary Power Port Pins		
PIN	Signal	Description
1	Ground	Frame/Earth Ground
2	DC-	Input Power Supply Ground
3	DC+	Input Power Supply Voltage

Wiring Characteristics

- Solid/Stranded Wire: 12-24 AWG (2.5-0.2mm²)
- Strip length: 0.28" (7mm)
- Torque, Terminal Hold-Down Screws: 4.5 – 7 in•lbs (0.50 – 0.78 N•m)

DC- is internally connected to I/O V-. A Class 2 power supply must be used.

Power Up

1. **Optional:** Attach ferrite core with a minimum of two turns of the DC+ and DC- signals from the DC supply that is powering the controllers.



HG-006

2. Connect to earth ground.
3. Apply recommended power.

DIGITAL I/O SPECIFICATIONS

- CPU250 Only -

Digital DC Inputs

Inputs per Module	8
Commons per Module	1
Input Voltage Range	0-24VDC
Absolute Maximum Voltage	30VDC Maximum
Input Impedance	120kΩ
Minimum "On" Current	1mA
Maximum "Off" Current	200μA
ON Voltage Level	6.8V
OFF Voltage Level	4.5V
Standard Speed Maximum Frequency	100Hz
High Speed Inputs	4
OFF to ON Response	Maximum 0.1ms
ON to OFF Response	Maximum 0.1ms
HSC Maximum Frequency	500kHz
Galvanic Isolation	None
Logic Polarity	Selectable in Cscape
I/O Indication	Yes
High Speed Functions (Modes) Supported	Totalizer, Frequency Counter, PWM, Quadrature

Digital DC Outputs

Outputs per Module	10
Commons per Module	1
High Speed Outputs	2
Output Type	Sourcing
Absolute Maximum Voltage	28VDC
Output Protection	Short Circuit
I/O Indication	Yes
Galvanic Isolation	None
OFF to ON Time (typical)	Maximum 0.1ms
ON to OFF Time (typical)	Maximum 0.1ms
High Speed Functions (Modes) Supported	Normal, HSC Out , PWM, and Stepper
Maximum Load Current per Output (Q1-8)	0.5A
Maximum Load Current per Common	2A
Maximum Load (Q9-10)	2A
Output Characteristics	Current Sourcing

FLEXIBLE INPUTS - DIGITAL/ANALOG SPECIFICATIONS

- CPU250 Only -

Flexible Inputs - Digital /Analog

Number of Channels	8
Conversion Rate	100Hz
Configured as Analog Inputs	
Analog Input Ranges	0-10V, 4-20mA, 0-20mA
Analog Input Data Ranges	0-32,000, (Adjustable from Cscape)
Configured to Digital Inputs	
Digital Input Threshold	24V / 12V / 5V / Custom
Input Voltage Range	0-24VDC
Absolute Maximum Voltage	30VDC
Input Impedance	1M Ω
OFF to ON Response	Maximum 1ms
ON to OFF Response	Maximum 1ms
Logic Polarity	Software Configurable in Cscape
ON Voltage Level	Adjustable
OFF Voltage Level	Adjustable
Minimum ON Current	1mA
Maximum OFF Current	200 μ A
Status Indicator	Yes
Maximum Error at 25°C (excluding zero)	0.4%

ANALOG OUTPUT SPECIFICATIONS

- CPU250 Only -

Analog Outputs

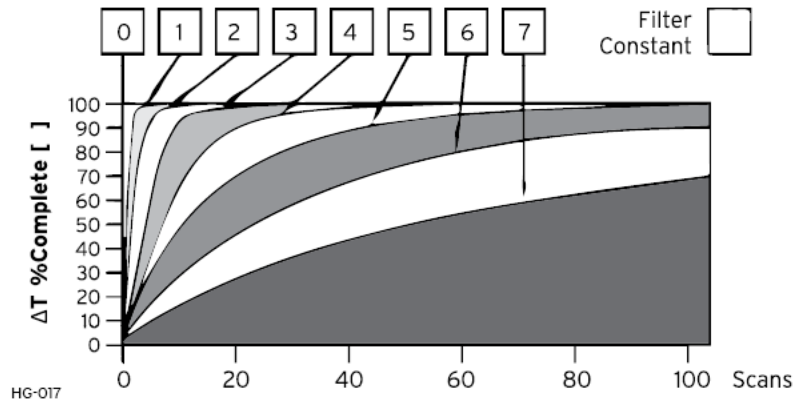
Number of Channels	8
Output Ranges	4 x 4x 0-20mA/4-20mA, 4 x 0-10VDC
Analog Output Data Ranges	0-4000/-2000-2000/0-1000/0-2000/0-32000
Galvanic Isolation	None
Nominal Resolution	12 Bits
Minimum Load (Voltage)	500Ω
Minimum Load (Current)	50Ω
Maximum Load (Current)	500Ω
Conversion Rate	100Hz
Response Time	12ms
Maximum Error at 25°C (Excluding Zero)	0.4%

WIRING: INPUTS AND OUTPUTS

- CPU250 Only -

Analog Inputs Information

Raw input values for channels 1-4 are found in the registers as Integer- type data with a range from 0 – 32000. Analog inputs may be filtered digitally with the Filter Constant found in the Cscape Hardware Configuration for Analog Inputs. Valid filter values are 0-7 and act according to the following chart:



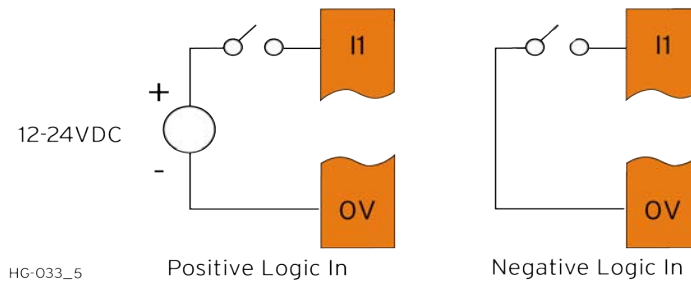
Data Values	
Mode	Data Format, 12-bit INT:
0-10mA	0 to 4000, -2000 to 2000, 0 to 1000 and 0 to 32000
0-20mA	0 to 4000, -2000 to 2000, 0 to 1000 , 0 to 2000 and 0 to 32000
4-20mA	0 to 4000, -2000 to 2000, 0 to 1000 , 400 to 2000 and 0 to 32000

Digital Inputs (I1-8)

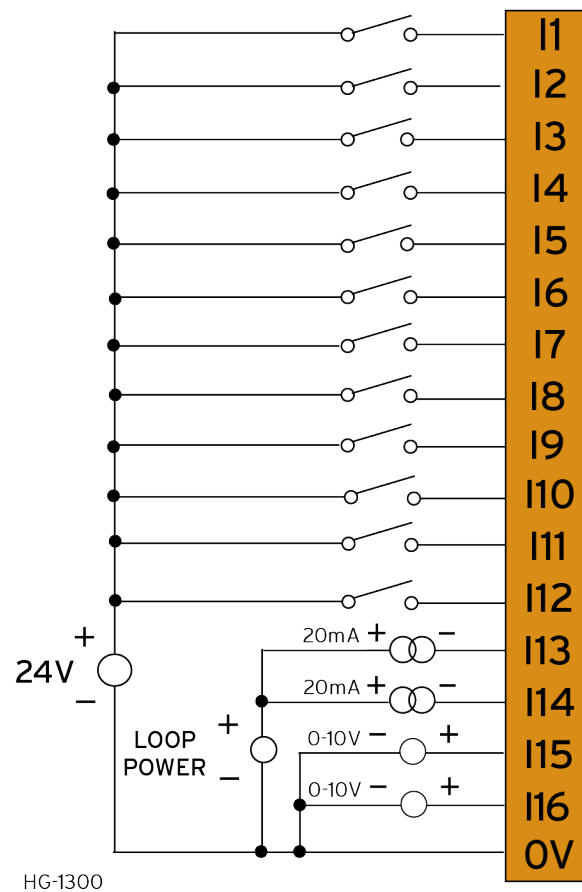
- CPU250 Only -

Positive Logic vs. Negative Logic

The OCS can be wired for positive or negative logic inputs.



Digital inputs may be wired in either a Positive Logic or Negative Logic, as shown. The setting in the Cscape Hardware Configuration for the Digital Inputs must match the wiring used in order for the correct input states to be registered. The state of the inputs are reflected in registers %I1 – %I8. The Common connections are found on the top connector.



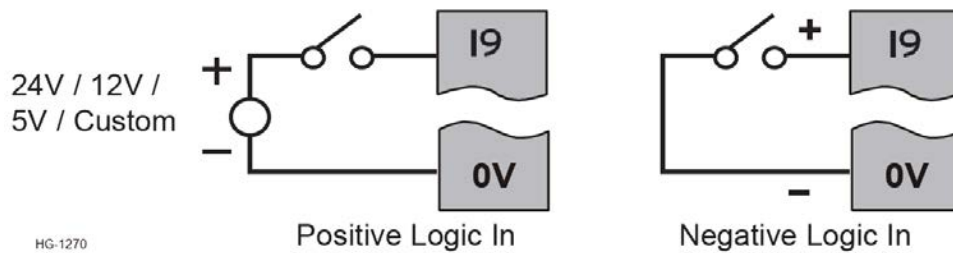
Flexible Inputs (I9-16)

- CPU250 Only -

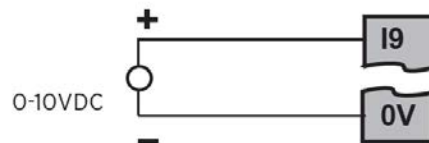
Positive Logic vs. Negative Logic Wiring

The CPU250 can be wired for positive or negative logic inputs while in digital mode.

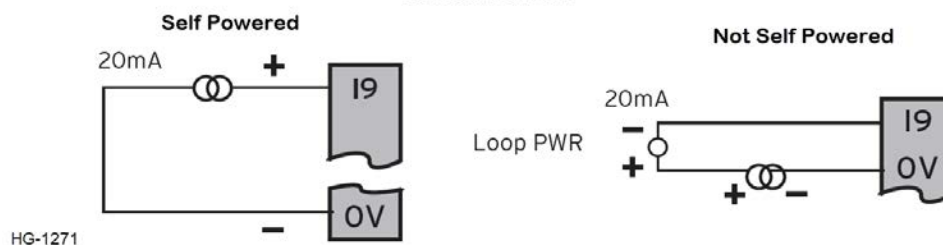
Important: Do not apply more than 5V to the input when configured as Current Mode input. If the current limit is exceeded, the device will activate over current protection mode and disable the input. The device must be switched to Idle mode before the input is re-enabled. The status of overcurrent protection is listed in %SR196.



Voltage Mode



Current Mode



Output Wiring

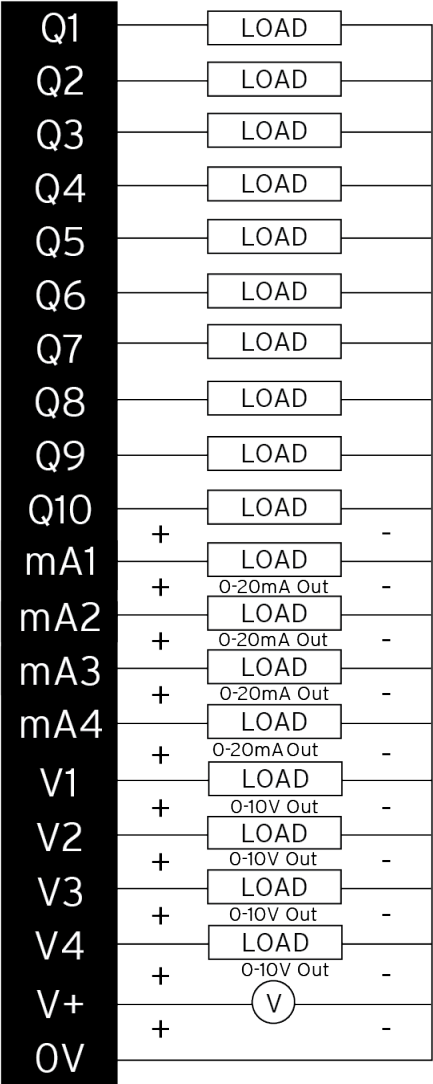
- CPU250 Only -

Digital, Voltage, and Current

Q1 to Q10
Digital Outputs

V1 to V4
Voltage Outputs

mA1 to mA4
Current Outputs



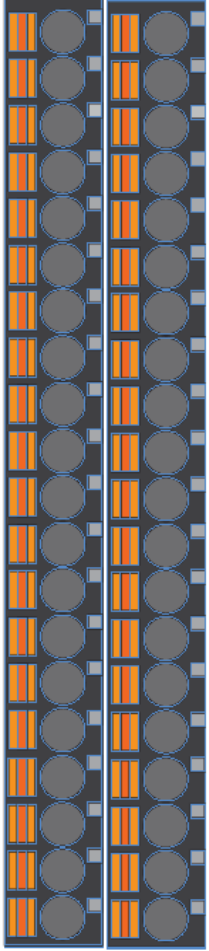
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Built-In I/O

- CPU250 Only -

Digital and Analog I/O Functions

Registers		Description
%I1 to %I8		Digital Inputs
%I9 to %I16	%AI1-%AI8*	Flex Inputs
%Q1 to %Q10		Digital Outputs
%AQ1 to %AQ4		Current Outputs
%AQ5 to %AQ8		Voltage Outputs
%SR196		Overcurrent Protection Status
*Flexible Inputs are assigned to %I when configured as Digital Inputs, and %AI when configured as Analog Inputs		

CPU250 Port Map					
	I1	Q1	Digital Inputs	Commons	Voltage Outputs
	I2	Q2	I1	0V	V1
	I3	Q3	I2	0V	V2
	I4	Q4	I3	0V	V3
	I5	Q5	I4	0V	V4
	I6	Q6	I5		
	I7	Q7	I6	Digital Outputs	Current Outputs
	I8	Q8	I7	Q1	mA1
	I9	Q9	I8	Q2	mA2
	I10	Q10		Q3	mA3
	I11	mA1	Flexible Inputs	Q4	mA4
	I12	mA2	I9	Q5	
	I13	mA3	I10	Q6	External Voltage Input
	I14	mA4	I11	Q7	V+
	I15	V1	I12	Q8	
	I16	V2	I13	Q9	
0V	V3	V4	I14	Q10	
0V	0V	0V	I15		
0V	V+		I16		

COMMUNICATIONS

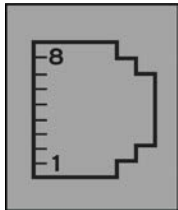
Serial Communication

MJ1/2 Serial Ports

Two serial ports are provided using the single 8-position modular jack labeled MJ1/2.

- **MJ1** defaults to one of several methods available to program the controller. It may instead be specified for RS-232 communications, such as for Modbus Master/Slave, or to communicate to devices such as bar code scanners.
- **MJ2** may only be used as half-duplex (2-wire) RS-485. The most common use is for Modbus communications, either as a Modbus Master or Modbus Slave, though other options are also available.

NOTE: To break pins out to terminals, use the [HE200MJ2TRM](#) accessory.



MJ1/2 SERIAL PORTS

MJ1: RS-232 w/full
handshaking

MJ2: RS-485 half-
duplex

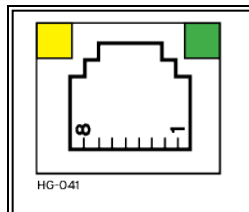
PIN	MJ1 PIN Assignments		MJ2 PIN Assignments	
	SIGNAL	DIRECTION	SIGNAL	DIRECTION
8	TXD	OUT	-	-
7	RXD	IN	-	-
6	0V	GROUND	0V	GROUND
5	+5V @ 60mA	OUT	+5V @ 60mA	OUT
4	RTS	OUT	-	-
3	CTS	IN	-	-
2	-	-	RX - / TX -	IN / OUT
1	-	-	RX + / TX +	IN / OUT

NOTE: Attach optional Ferrite Core (HE-FBD001) with a minimum of two turns of serial cable.

Ethernet

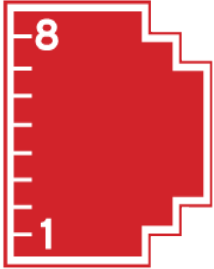
A 10/100 Ethernet port with automatic MDI-X (crossover detection) is provided via the single 8-position modular jack labeled LAN. Additional features are available for use over Ethernet, including WebMI, Modbus TCP/IP, Ethernet/IP, SMTP (E-mail), expansion I/O to SmartRail, and more.

Ethernet configuration is done via the Cscape Hardware Configuration. For more information on Ethernet, available features and protocols, refer to the Ethernet Supplement document (SUP0740).



Green LED indicates link - when illuminated, data communication is available.
Yellow LED indicates activity - when flashing, data is in transmission.

CAN Communications

		CAN Pin Assignments	
		PIN	SIGNAL
 HG-042	Modular jack (8p8c)	8	No Connection
		7	Ground
		6	Shield
		5	No Connection
		4	No connection
		3	Ground
		2	CAN Data Low
		1	CAN Data High

The CAN port is provided via the single 8-position modular jack labeled “CAN”. It may be used to communicate with other OCS products using the Horner CsCAN protocol. Remote expansion I/O such as SmartRail, SmartBlock, and SmartStix may be implemented using the CsCAN protocol.

Termination for the CAN port may be enabled from the System Menu or System Register. This should only occur if this device is at either end of the CAN network. Only the two devices on either end of the CAN network should be terminated.

Discrete Wiring

For CAN or serial connections the [HE200MJ2TRM](#) accessory will provide a modular connector to wiring block adapter for installations that require discrete wiring.



HG-043

Switch

The Load/Run/Stop switch in CPU250 is a multi-purpose switch which has three modes as shown in the following figure. This switch supports various functionalities, and some functionalities supported by a specific LED pattern that tells the user if the intended operation has started, completed, or failed.



A switch provides control of the following CPU250 modes: RUN, STOP, and LOAD.

Mode	Description
RUN	The unit is actively executing any programmed functions and operations.
STOP	Halts/stops the execution of all operations that may be underway.
LOAD	For loading a program from an microSD card and when updating firmware.

- The operational mode of the CPU250 may be changed with Cscape. If Cscape is used to force the device into Run mode while the switch is in Stop, the RUN LED will blink rapidly.
- If the mode is changed in Cscape to a mode that differs from the switch setting, a warning message will be presented to confirm.
- %SR58 can be used inhibit the ability of the switch to set the device to Run mode. Setting %SR58 to '1' means the run mode can only be changed from Cscape.

microSD Slot

A microSD card may be used for data and alarm logging, historic trending, program loading, firmware updates, and other features. Supported types of microSD cards are SD, SDHC, and SDXC if the format of the card file system is FAT32.

Status LEDs

Firmware Download In Progress/Complete Indicators

- OK and RUN flashing alternately indicates a firmware download is in progress.
- When the flashing stops, the firmware download is complete and the unit reboots (approximately 30 seconds).

NOTE: When flashing together, the firmware download has failed, and the number of flashes indicates the error. There will be a two second gap and the pattern will be repeated. The number of flashes and the associated error are as follows:

- 2 Flashes - The MAC ID is empty.
- 3 Flashes - The internal MAC file is corrupt.
- 4 Flashes - The MAC ID TXT file is invalid.
- 5 Flashes - The MAC ID file is not found or the microSD card is empty or missing system files.

LED BEHAVIOR UNDER DIFFERING CONDITIONS

Status	Power	OK	RUN	MS	NS
OFF	No power applied	Self-test fail	Stop mode	Self-Test of Remote I/O Fail	Network ID Fault or Duplicate ID Fault
ON	9-30VDC applied	Self-test pass	Run mode	Self-Test of Remote I/O OK & Configured	Network Normal
FLASHING (1Hz)	N/a	I/O forcing enabled	Do I/O mode (Amber)	Power-up State / Waiting for Configuration	Communications Timeout with OCS
Power ON without OCSIO modules connected	Solid Green	Any	Any	OFF	Blinking Green (modules not detected)
Power ON with OCSIO modules connected	Solid Green	Any	Any	Blinking Green (configuration mismatch)	Solid Green On (Modules detected)
OCSIO configuration downloaded	Solid Green	Any	Any	Solid Green (configuration matched)	Solid Green On (Modules detected)
Diagnostics OK	Solid Green	Solid Green	OFF	Any	Any
Diagnostics not OK (fault indication)	Solid Green	OFF	OFF	Any	Any
Device in STOP mode	Solid Green	Any	OFF	Any	Any
Device in RUN mode	Solid Green	Any	Solid Green	Any	Any
Device forced to RUN mode using Cescape while switch in STOP position	Solid Green	Any	Blinking Green	Any	Any
Device in DO I/O Mode	Solid Green	Solid Green	Blinking Yellow	Any	Any
BOOT update	Solid Green	OFF	OFF	OFF	OFF
Firmware Update	Solid Green	Blinking Green	Blinking Green	Any	Any
Program Clear	Solid Green	Any	OFF	Blinking red for 30 seconds	Any
Program Load Start	Solid Green	Any	OFF	Blinking Green	Blinking Green
Program Load Fail	Solid Green	OFF	OFF	Blinking red for 3 seconds	Blinking red for 3 seconds

LED BEHAVIOR UNDER DIFFERING CONDITIONS

CPLD Loaded successfully	Solid Green	Blinks green for 5 times after 30 seconds	OFF	OFF	OFF
Calibration Mode ON	Solid Green	Blinking green at 2Hz	Any	Any	Any
I/O Forcing	Solid Green	Blinking green at 1Hz	Any	Any	Any

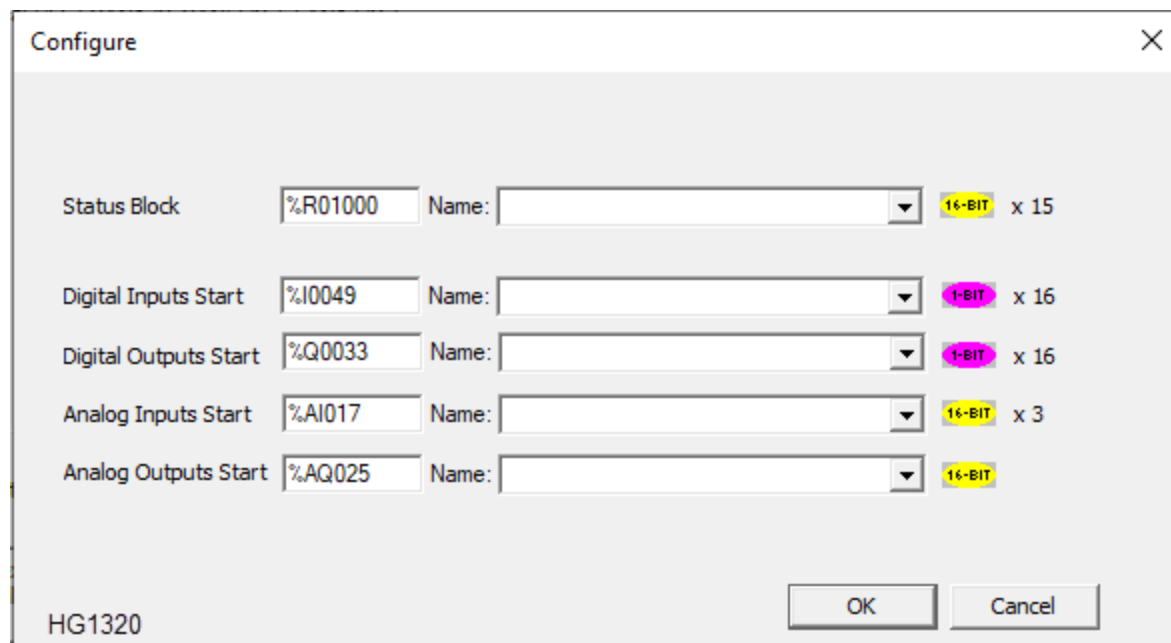
CSCAPE CONFIGURATION

The OCS-I/O is configured from Cscape, under "Hardware Configuration." Check the release notes on the OCS model to ensure OCS-I/O support is included.

NOTE: Cscape 10.1 and beyond is required.

General configuration steps:

1. In Cscape, select Controller > Hardware Configuration.
2. Confirm that the OCS controller has been selected.
3. Select the "Local I/O" tab.
4. Click the "Edit I/O" button. This opens the following dialog:

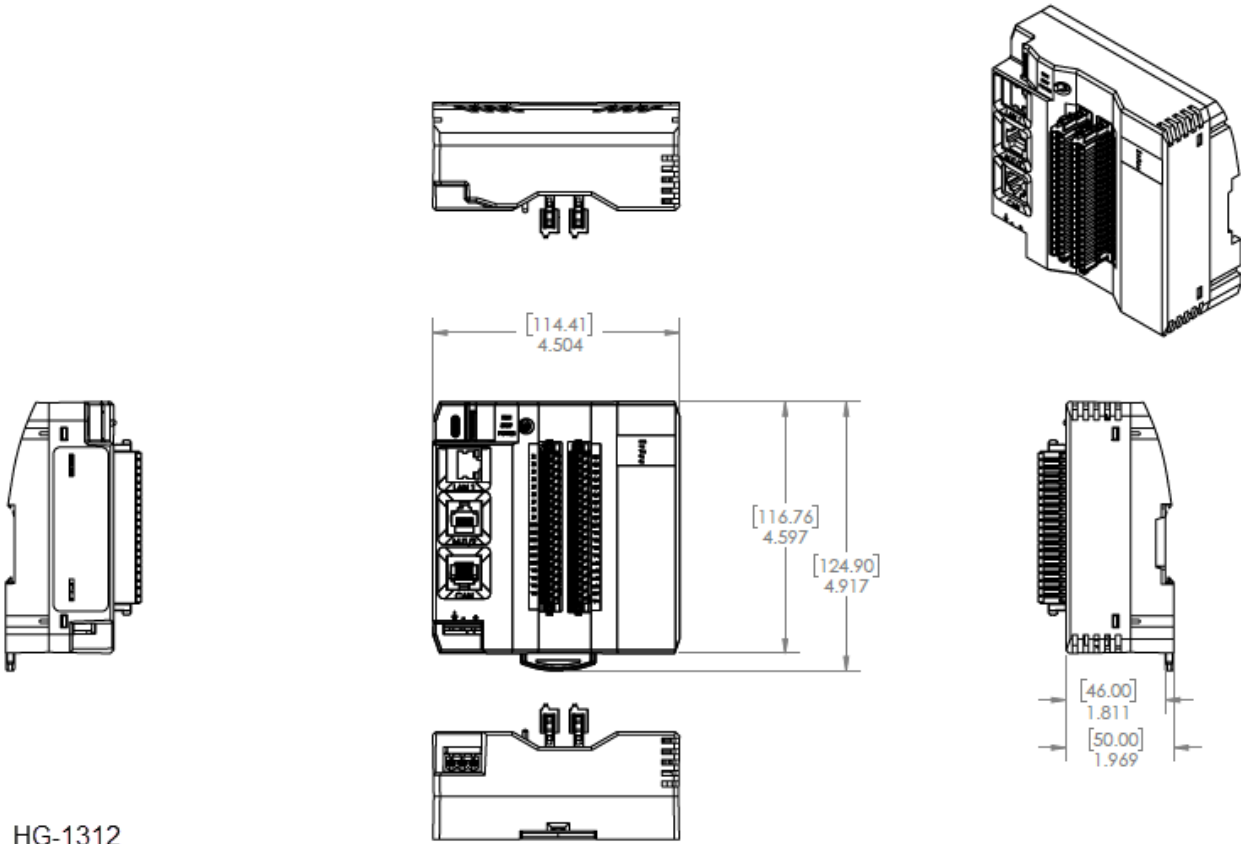


Field Name	Description
Status Register	Location where fifteen consecutive words are reported
Digital Inputs / Digital Outputs / Analog Inputs / Analog Outputs Start	Starting locations for each type of I/O for this base. Choose a starting addresses that does not conflict with the OCS built-in I/O mapping.

5. After entering all the required information (above), click “OK”. The following Hardware Configuration dialog will appear.
 - Modules can be added using the “Add Module” button. As I/O modules are added the Input Map, Output Map, and Current Draw are updated, showing the accumulated I/O Module Information. More details regarding each module can be viewed using the “More Info” button.
 - If the OCS and I/O modules are correctly connected and powered up, and if Cscape currently has communications to the OCS, the “Auto Populate IO” button may be used to recognize all modules installed on this OCS.
 - Right-clicking on an OCS module permits additional detailed configuration to be performed, as follows:
 - Digital Input modules can be configured to update on a change of state (typical) or periodically (rare). Input filtering can also be adjusted from the default of 1ms.
 - Digital Output modules can optionally be configured to hold last state in Stop/Idle mode.
 - Analog Input modules can be configured with an update rate of 10ms to 255 seconds. Analog Inputs also have configurable data type and range which varies by module type.
 - Analog Output modules have configurable type and range, and also can have Stop/Idle behavior adjusted to Hold Last State, or go to Minimum (default), Medium or Maximum value.
6. Press “OK” to complete the process.
7. Up to 7 I/O modules can be connected to CPU250 as Local IO

DIMENSIONS & INSTALLATION

CPU200/250 Dimensions



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.

This OCS may only be used in the Class I, Division 2, Groups A, B, C and D Hazardous Locations only.

Temperature Ranges

- The operating temperature range is -40°C to +60°C.
- The storage temperature range is -40°C to +70°C.

Summary

- The HE959CPU200/250 is compact and mounts on DIN-rail. Each I/O module installed adds width in increments of 19mm.

NOTE: The distance between wiring duct and surrounding modules, above and below each module, should be a minimum of 50mm apart.

- Modules can be added after the HE959CPU200/250 base has been installed on the DIN-rail and can be hot swapped with power applied.

NOTE: I/O scanning will stop until the correct modules for the system are detected in all slots.

Installation Instructions

Devices are to be installed into an enclosure suitable for the environment and that is only accessible with the use of a tool.

DIN Rail Overview

- Modules mount on a DIN rail. Be certain that the DIN rail is in a horizontal position before installing the unit. A horizontal orientation is required to prevent the unit from slipping off the DIN rail.
- The module is compact and mounts on the DIN rail. Each I/O module installed adds width in increments of 19mm. The distance between wiring duct and surrounding modules must be at least 50mm apart.
- Modules can be added after the base has been installed on the DIN rail and can be hot swapped with power applied. (I/O scanning will stop until the correct modules for the system are detected in all slots.)
- The spade connector for grounding and the DIN rail clip add to the overall measurements. The CAN/PWR and LAN connectors also add to the measurements.
- Screw holes and a spade connector are available as a mounting option.

How to Install the Modules

1. Connect the bus connectors to each other to form a backplane that can accept up to 8 modules, including the CPU200/250 or another base.
2. Snap the bus connectors into the DIN rail. The DIN rail should be 35 mm × 7.5 mm and made to EN 60715 standards.
3. Place the HE959CPU200/250 or other bus head to the leftmost connector.
4. Insert modules by latching at the top of the DIN rail first and then rocking downward until the latch at the bottom of the DIN rail engages.



How to Remove the Modules

Modules may be removed while powered, however I/O scanning on the remaining modules will stop and I/O will go into the default state until a new module is inserted and all modules in the configuration are present.

1. Insert a flat-blade screwdriver into the into the metal DIN rail latch at the bottom of the module.
2. Pry downwards to the release latch.
3. Rock the module up and off the DIN Rail.

SAFETY & MAINTENANCE

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.
6. 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.

7. **WARNING:** Battery may explode if mistreated. Do not recharge, disassemble, or dispose of in fire.

8. **WARNING:** EXPLOSION HAZARD - Batteries must only be changed in an area known to be non-hazardous.

9. **WARNING:** Do not disconnect while circuit is live unless area is known to be non-hazardous.

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 connections 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. Use caution when connecting controllers to PCs via serial or USB. PCs, especially laptops, may use "floating power supplies" that are ungrounded. This could cause a damaging voltage potential between the laptop and controller. Ensure the controller and laptop are grounded for maximum protection. Consider using a USB isolator due to voltage potential differences as a preventative measure.

Technical Support

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