

**SCADAPack E 5304 Analog
Output Hardware Manual**



Documentation

Table of Contents

Part I	5304 Analog Output Module	3
1	Technical Support.....	3
2	Safety Information.....	4
3	Overview	6
4	Installation.....	8
5	Power Supply Requirements.....	10
6	DIP Switch Settings.....	11
7	Analog Outputs.....	12
7.1	Current & Voltage Outputs	14
7.2	Range and Resolution	16
8	Operation and Maintenance	16
8.1	Troubleshooting	17
9	Calibration.....	18
10	Specifications.....	20
11	Approvals and Certifications.....	22

I 5304 Analog Output Module



Documentation

©2013 Control Microsystems Inc.
All rights reserved.
Printed in Canada.

Version: 8.05.4

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

1 Technical Support

Support related to any part of this documentation can be directed to one of the following support centers.

Technical Support: The Americas

Available Monday to Friday 8:00am – 6:30pm Eastern Time

Toll free within North America 1-888-226-6876

Direct Worldwide +1-613-591-1943

Email TechnicalSupport@controlmicrosystems.com

Technical Support: Europe

Available Monday to Friday 8:30am – 5:30pm Central European Time

Direct Worldwide +31 (71) 597-1655

Email euro-support@controlmicrosystems.com

Technical Support: Asia

Available Monday to Friday 8:00am – 6:30pm Eastern Time (North America)

Direct Worldwide +1-613-591-1943

Email TechnicalSupport@controlmicrosystems.com

Technical Support: Australia

Inside Australia 1300 369 233

Email au.help@schneider-electric.com

2 Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

	The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.
---	--

	This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
---	--

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ CAUTION**EQUIPMENT OPERATION HAZARD**

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.

- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in injury or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

3 Overview

The Model 5304 analog output module adds four analog outputs to the 5000 input/output (I/O) system. Up to 16 Model 5304 modules may be connected to the 5000 I/O bus for a total of 64 analog outputs.

The 5304 outputs can control valve actuators, motor speed controllers, temperature

controllers or any device requiring an analog control signal.

The 5304 module generates either current or voltage outputs. In current mode, it can generate either 0 to 20mA outputs or 4 to 20mA outputs. A configuration switch selects the output range. In voltage mode, the outputs can be either 0 to 5V or 0 to 10V. The configuration switch will then select the ranges 1 to 5V and 2 to 10V respectively.

The output resolution is 12 bits. Outputs are isolated from logic circuits, for protection against voltage transients and high common mode voltages.

The 5304 module requires an external 12 to 24 volt DC power supply to power the output circuitry.



4 Installation

The installation of the 5304 analog output module requires mounting the analog output module on the 7.5mm by 35mm DIN rail and connecting the analog output module to the system I/O Bus. Refer to the **System Configuration Guide** for complete information on system layout, I/O Bus cable routing and analog output installation.

Field Wiring

The 5304 Analog Output module provides analog outputs. These outputs are isolated from the I/O Bus 5V power supply. These outputs are not isolated from each other as they share a common return.

CAUTION

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the maximum voltage specified for each input.

Failure to follow these instructions can result in equipment damage.

An external 24V supply powers the isolated output circuits. This is usually the same power supply that powers current loop transmitters in the system. A power supply normally sources this power. A wide range of voltages is tolerated. Refer to section [Specifications](#)^[20] of this manual for details.

Recommended field wiring for the 5304 modules is shown in **Figure 1:5304 Typical Field Wiring**.

The 12-24V supply connects to terminals 1 and 2. Observe correct polarity. See section [Power Supply Requirements](#)^[10] for application suggestions when selecting this power supply.

- The first output connects to terminals 3 and 4. Observe correct polarity.
- The second output connects to terminals 5 and 6. Observe correct polarity.
- The third output connects to terminals 7 and 8. Observe correct polarity.
- The fourth output connects to terminals 9 and 10. Observe correct polarity.

Controller, modem and I/O modules use screw termination style connectors for termination of field wiring. They accommodate solid or stranded wires from 22 to 12 AWG.

The connectors are removable. This allows module replacement without disturbing the field wiring. Leave enough slack in the wiring for the connector to be removed.

Remove power before servicing unit.

To remove the connector:

- Pull the connector away from the board. Apply even pressure to both ends of the connector.

To install the connector:

- Line up the pins on the module with the holes in the connector.
- Push the connector onto the pins. Apply even pressure to both ends of the connector.

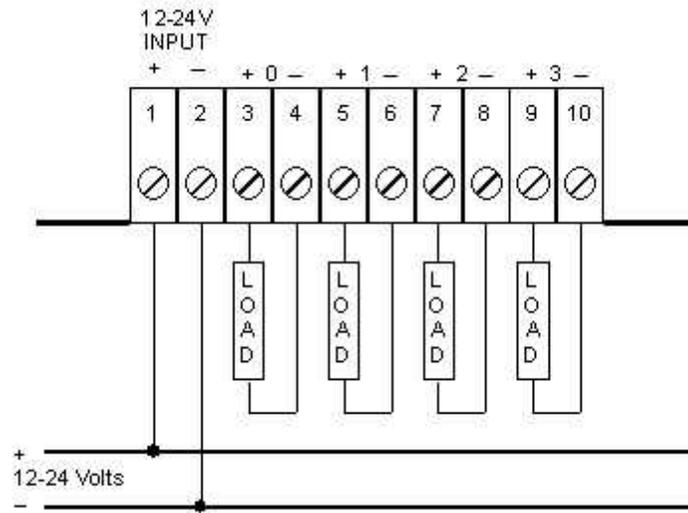


Figure 1: 5304 Typical Field Wiring.

ATEX and IECEx applications only

This equipment is to be installed in an enclosure certified for use, providing a degree of protection of IP54 or better. The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating. A T4 rating is acceptable.

5 Power Supply Requirements

The analog output section requires a DC power supply. The voltage should normally be in the 12-24Vdc range although there are cases where a voltage higher than 12V is necessary. Refer to the specifications for the minimum power input voltage. When a 5V or 10V output is required and the output current approaches the maximum specified it will be necessary to use a power source that is greater than 12V.

The power can be supplied from any one of several sources depending on the application. Controllers that have 12V to 24Vdc power converters or power supplies can be used. External 24Vdc power supplies that are powering other components in the system can be used. 12V batteries can be used in applications subject to the minimum voltages described above and in the specifications.

6 DIP Switch Settings

Address Selection

5000 Series I/O module types may be combined in any manner to the maximum supported by the controller used.

Each type of I/O module, connected to the I/O bus, needs to have a unique I/O module address. Different types of I/O modules may have the same module address.

The address range supported by the controller module may restrict the I/O module address range. Refer to the controller manual for the maximum address supported.

The four address switches labeled 8, 4, 2, and 1 set the address.

To set the address:

- Open the four switches by sliding the actuators to the “OFF” position.
- Close the switches that total to the desired address by sliding the actuators to “ON”.

Switch settings for each of the 16 module addresses are shown in **Figure 2: 5304 Analog Output Module Address Switches**

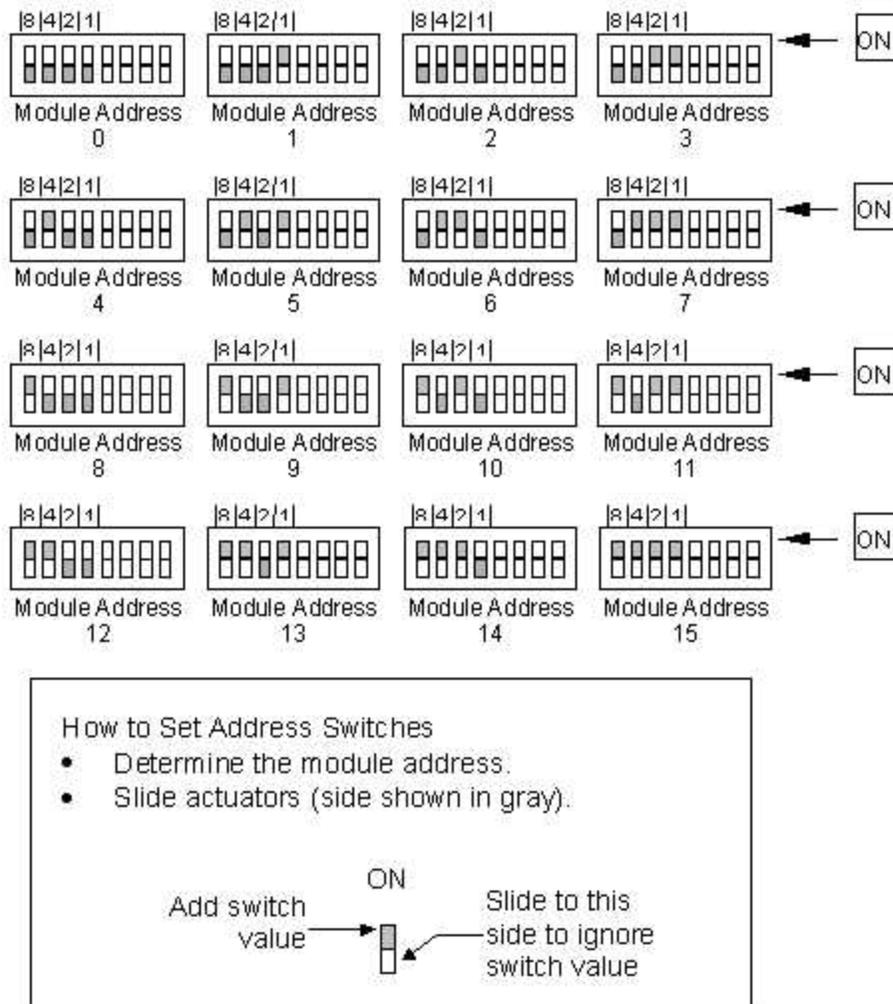


Figure 2: 5304 Analog Output Module Address Switches

7 Analog Outputs

The 5304 Analog Output Module includes four channels of analog outputs.

- Use SCADAPack E Configurator to assign RTU database points to the I/O card channels
- For ISaGRAF applications use I/O board connections to the RTU point database (rtuxxx boards) to write the analog outputs.

Please refer to the ISaGRAF software and SCADAPack E Configurator manuals on how to assign RTU points to use ISaGRAF I/O Boards and Complex Equipment types.

-
- [Current & Voltage Outputs](#)¹⁴
 - [Range and Resolution](#)¹⁶
-

7.1 Current & Voltage Outputs

The outputs are calibrated at the factory in either current or voltage mode, depending on module version. An output requires re-calibration upon changing its operating mode. See section **Analog Output Calibration** for details.

Each output is independently configurable as either a current or a voltage mode output. Furthermore, in voltage mode, two ranges are available: 5V and 10V full scale. Three jumper links per channel are used to select the operating mode:

- J1, J2, J9 for Channel 0
- J3, J4, J10 for Channel 1
- J5, J6, J11 for Channel 2
- J7, J8, J12 for Channel 3

The valid configurations are presented in **Figure 3: 5304 Current/ Voltage Mode Selection** and an example is given in **Figure 4: 5304 Mixed Configuration Example**

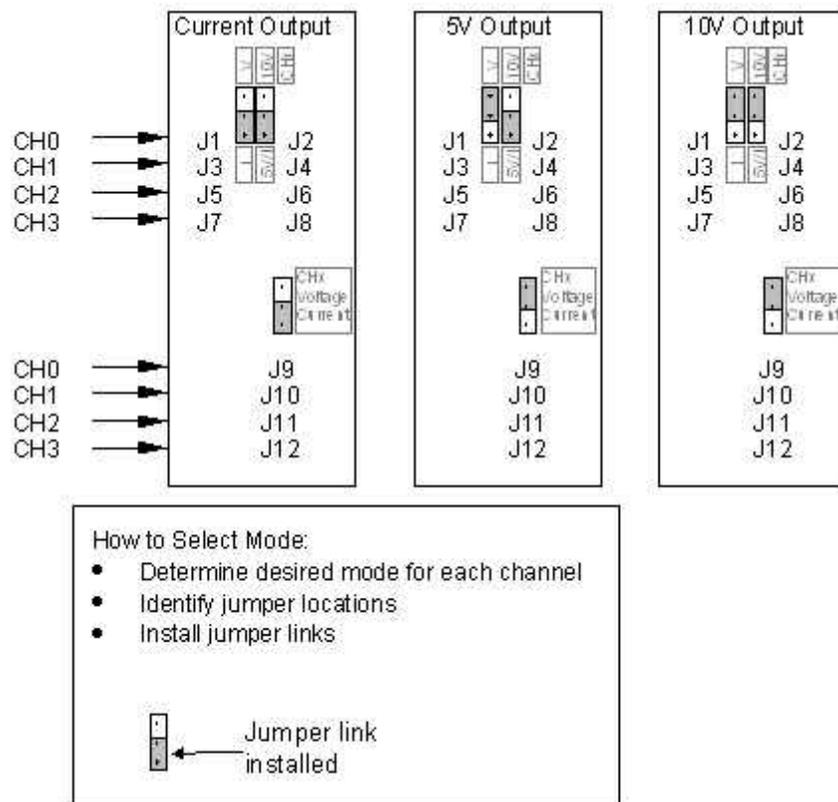


Figure 3: 5304 Current/ Voltage Mode Selection

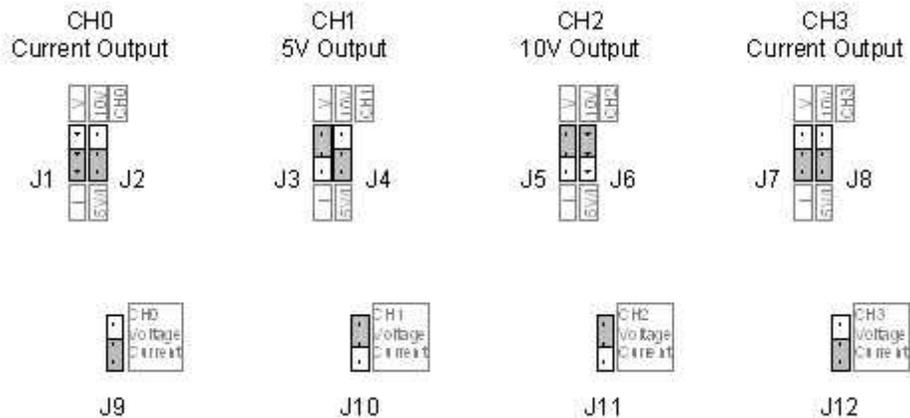


Figure 4: 5304 Mixed Configuration Example

Output Offset Selection

The 5304 Analog Output Module can be configured to output a 0-20mA or 4-20mA signal when operating in current mode. When configured for voltage mode, the available ranges are 0-5V or 1-5V and 0-10V or 2-10V respectively, depending on the mode selected.

The offset is set independently for each of the four channels.

To select the 0-20mA/ 0-5V/ 0-10V range:

- Slide the actuator of the offset switch to the position labeled 0-20mA.

To select the 4-20mA/ 1-5V/ 2-10V range:

- Slide the actuator of the offset switch to the position labeled 4-20mA.

The outputs of the module will be 0mA or 0V during a system reset, regardless of the offset setting. When the system reset is over, the outputs will go to 0mA/ 0V/ 0V or 4mA/ 1V/ 2V, as configured by the mode and offset settings.

The switch setting for the output offset is shown in **Figure 5: 5304 Output Offset Switch**.

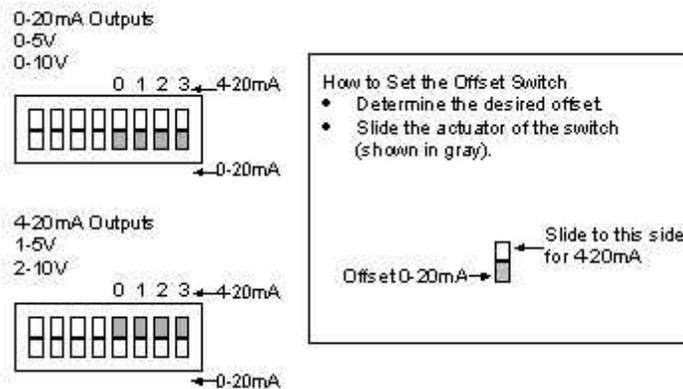


Figure 5: 5304 Output Offset Switch

7.2 Range and Resolution

The 5304 analog output module has a 12 bit, unipolar, digital to analog (D/A) converter. Using DIP switches, as described in the [Current & Voltage Outputs](#) ^[14] section, each channel on the 5304 can be configured for one of the following output ranges:

- 0 - 20mA
- 4 - 20mA
- 0 - 5V
- 1 - 5V
- 0 - 10V
- 2 - 10V

The 0-20mA output range resolution is 4.88 μ A per D/A count.

Analog output points for the 5304 module are added to the RTU Configuration using the SCADAPack E Configurator SCADAPack I/O property page. Configuration for each of these analog output points uses the SCADAPack E Configurator Analog Points property page. The Raw Min. to Raw Max. and Eng. Min. to Eng. Max. parameters are used for integer and engineering scaling, respectively.

8 Operation and Maintenance

Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Schneider Electric Technical Support for more information and instructions for returning the module for repair.

8.1 Troubleshooting

Condition	Action
Outputs are 0mA/ 0V.	Check the 12-24V power.
The full scale output is less than 20mA in current mode.	Check the 12-24V power. Check that the load resistance is within specification.
The full scale output is less than 5V/ 10V in voltage mode.	Check the 12-24V power. Check that the load resistance is within specification.
The output is 4mA when a value of 0 is output. 0mA was expected.	The 4-20mA output offset is selected. Select the 0-20mA offset.
The output is 0mA when a value of 0 is output. 4mA was expected.	The 0-20mA output offset is selected. Select 4-20mA offset.
The voltage output reading seems to be about half what is expected.	Check the load resistance is within the specification. Check the output is not a 5V one, instead of 10V.
The output seems to be uncalibrated at high output values. This improves somewhat as lower values are output.	Check the load resistance is within the specification. Check the output is a current mode one.
The output seems to be uncalibrated at small output values. This improves as larger values are output.	Check the setting of the output offset switch. The wrong output offset is probably selected.

9 Calibration

The 5304 Analog Output module is calibrated at the factory and should not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage or if the outputs have been reconfigured.

There are eight potentiometers for calibration of the analog outputs – two for each channel. Potentiometers Gain0, Gain1, Gain2, Gain3 adjust the gain of channels 0 through 3 respectively, while Offset0, Offset1, Offset2, Offset3 adjust the offset of channels 0 through 3 respectively.

Analog output calibration requires that you write values to each channel of the 5403 analog output module. Using the SCADAPack E Configurator Point Browser property page, values between the Raw Min and Raw Max point properties can be written to the 5304 module. Set the Perform Automatic Read check box to have SCADAPack E Configurator write to the point continuously while calibration is being performed.

The analog type and range are set individually for each channel using jumpers on the 5403 module. See the [Current & Voltage Outputs](#)¹⁴¹ section for jumper positions for each channel..

The gain and offset potentiometers are labeled for each analog output channel as shown in the picture below.



Figure 6: Location of Gain and Offset potentiometers.

<u>Channel</u>	<u>Gain Potentiometer</u>	<u>Offset Potentiometer</u>
Channel 0	Gain0	Offset0
Channel 1	Gain1	Offset1
Channel 2	Gain2	Offset2
Channel 3	Gain3	Offset3

Current Outputs Calibration

For this procedure it is assumed that the output channel is a current output. To calibrate the current outputs of the 5304 Analog Output module:

1. Connect the 5304 to a controller module. Apply 24 volts to the 5304 terminal block P3 on terminals 1 and 2, observing polarity.
2. Set the output range for the channel to 0-20mA.
3. Output a data value of **Raw Max.** to the channel to be calibrated.
4. Measure the output current of the channel in series with a 250 Ω load resistor. Adjust the corresponding Gain potentiometer (see table above) for an output of 19.990mA.
5. Output a data value of 2.5% of the **Raw Max.** value. For a **Raw Max.** value of 10000 this value is 250.
6. Measure the output current of the channel in series with a 250 Ω resistor. Adjust the corresponding Offset potentiometer (see table above) for an output of 498 μ A.
7. Repeat the above procedure for each current output channel.

5V Outputs Calibration

It is assumed that the output channel is a 5V voltage output. To calibrate the 5V outputs of the 5304 Analog Output module:

1. Connect the 5304 to a controller module. Apply 24V to the 5304 terminal block P3 on terminals 1 and 2, observing polarity.
2. Set the output range for the channel to 0-5V.
3. Output a data value of **Raw Max.** to the channel to be calibrated.
4. Measure the output voltage of the channel. Adjust the corresponding Gain potentiometer (see table above) for an output of 4.995V
5. Output a data value of 2.5% of the **Raw Max.** value. For a **Raw Max.** value of 10000 this value is 250.
6. Measure the output voltage of the channel. Adjust the corresponding Offset potentiometer (see table above) for an output of 0.125V.
7. Repeat the above procedure for each 5V voltage output channel.

10V Outputs Calibration

It is assumed that the channel is configured as a 10V voltage output. To calibrate the 10V outputs of the 5304 Analog Output module:

1. Connect the 5304 to a controller module. Apply 24V to the 5304 terminal block P3 on terminals 1 and 2, observing polarity.
2. Set the output range for the channel to 0-10V.
3. Output a data value of **Raw Max.** to the channel to be calibrated.
4. Measure the output voltage of channel 0. Adjust the corresponding Gain potentiometer (see table above) for an output of 9.990V.
5. Output a data value of 2.5% of the **Raw Max.** value. For a **Raw Max.** value of 10000 this value is 250
6. Measure the output voltage of channel 0. Adjust the corresponding Offset potentiometer (see table above) for an output of 0.249V.
7. Repeat the above procedure for each 10V voltage output channel.

10 Specifications

Disclaimer: Schneider Electric reserves the right to change product specifications without notice. For more information visit <http://www.schneider-electric.com>.

Output Points	Four
Output Modes	Current mode, jumper link selectable Voltage mode, 5V full scale, jumper link selectable Voltage mode, 10V full scale, jumper link selectable
Output Signal Ranges	0-20mA or 4-20mA, switch configurable 0-5V or 1-5V, switch configurable 0-10V or 2-10V, switch configurable
Output Type	Single ended regulation on positive side with common negative return
Maximum Load Resistance in Current Mode	1000 Ω with 24V DC loop power 400 Ω with 12V DC loop power 250 Ω with 9V DC loop power
Minimum Load Resistance in Voltage Mode	2k Ω for 10V full scale, with min 20V power applied 1k Ω for 5V full scale, with min 15V DC power applied
Isolation	500Vac field to logic
D/A Resolution	12 bits over the 0-20mA/ 0-5V/ 0-10V ranges

Absolute Accuracy	+/- 0.05 % of full scale at 25 ^o C (77 ^o F) +/- 0.2 % of full scale over temperature range
Noise and Ripple	0.04% maximum
Transient Protection	600 watt transient suppressor on each output and power input 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Response Time	2ms typical to 90% signal change
Addressing	DIP switch configurable
5V Power Requirements	6 mA minimum. 25mA maximum. This current is a function of controller, I/O size and data.
DC Power Requirements	15mA quiescent plus 80mA max. in current mode 15mA quiescent plus 20mA max. in voltage mode
DC operating voltage limits	9V or (20mA x load resistance) + 4V (which ever is greater) in current mode (1.5 x Range / load resistance) + Range + 2.5V in voltage mode 30V maximum. UL508 rated 13.75-28Vdc. Class 2.
Terminations	10 pole, removable terminal block 12 to 22 AWG, 15 amp contacts Screw termination - 6 lb.-in. (0.68 Nm) torque
Dimensions	4.25 inch (108 mm) wide 4.625 inch (118 mm) high 1.75 inch (44 mm) deep
Mounting	7.5 x 35 DIN rail
Packaging	Corrosion resistant zinc plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing -40 ^o C to 70 ^o C -40 ^o F to 158 ^o F

11 Approvals and Certifications

Hazardous Locations - North America	<p>Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4</p> <p>UL Listed and CSA approved to the following standards:</p> <ul style="list-style-type: none"> • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	<p>ATEX II 3G, Ex nA IIC T4</p> <p>per EN 60079-15, protection type n (Zone 2)</p>
Hazardous Locations	<p>IECEX, Ex nA IIC T4</p> <p>per IEC 60079-15, protection type n (Zone 2)</p>
ATEX and IECEX Applications only	<p>This equipment is to be installed in an enclosure certified for use, providing a degree of protection of IP54 or better. The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating. A T4 rating is acceptable.</p> <p>For products using Solid State Relays (5415, 5606 and 5607 modules and SCADAPack using 5606 and 5607 modules) A T4 rating is acceptable for maximum loads of 2A. When 3A loads are connected to the Solid State Relays, the maximum ambient rating is lowered to 50°C in order to maintain the T4 rating.</p>
Safety	<p>CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL916. (Process Control Equipment, Industrial Control Equipment) in Canada and USA.</p> <p>UL (cULus) listed: UL508 (Industrial Control Equipment)</p>
Digital Emissions	<p>FCC47 Part 15, Subpart B, Class A Verification</p> <p>EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment</p> <p>C-Tick compliance. Registration number N15744.</p>
Immunity	<p>EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments</p>
Declaration	<p>This product conforms to the above Emissions and Immunity Standards and therefore conforms with the requirements of Council Directive 2004/108/EEC (as amended) relating to electromagnetic compatibility and is eligible to bear the CE mark.</p> <p>The Low Voltage Directive is not applicable to this product.</p>

