OM240
Linear & Polynomial Conversion
The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

AIM OF THIS MANUAL 4

HOW TO CONFIGURE THE CONVERSION 4

LINEAR CONVERSION 5
EXAMPLE OF LINEAR CONVERSION (C≠1) 6
Fields compilation on datalogger 6

POLYNOMIAL CONVERSION 9
EXAMPLE OF POLYNOMIAL CONVERSION WITH A 3rd DEGREE POLYNOMIAL 10
EXAMPLE OF POLYNOMIAL CONVERSION WITH A 2nd DEGREE POLYNOMIAL 11
SUBTRACTION OF THE ZERO READING 12
AIM OF THIS MANUAL

The aim of this manual is to explain how to insert the values of linear and polynomial conversion in the OM-240/OM-400/OM-500, from now on indicated simply as “data logger”. These values are used to convert the acquired readings from electrical unit (mA, Volt, digit, HZ, ecc…) to engineering unit (kPa, mm, etc…)

HOW TO CONFIGURE THE CONVERSION

NOTE: this procedure is applicable to local channels and multiplexer channels (multiplexer only for data logger)

To set up the conversion mode (linear or polynomial) the user has to:
- open the configuration page of the channel you want to set up.

in menu “Conversion”, select the kind of conversion you want to do between:
- Linear
- Polynomial

LINEAR CONVERSION

The formula used by OM-240/OM-400/OM-500 is:

\[ X \times C + Z \]

\[ X \] = current reading (electrical unit)
\[ C \] = instrument sensitivity
\[ Z \] = zero reading (or installation reading)

- Selecting the entry “Linear”, the following fields are enabled:
  - Zero Reading (Z)
  - Sensitivity (C)

Sensitivity (C): is the sensitivity indicated in the calibration report of the instrument in the following format

\[ \text{Eng Unit} \]
\[ \text{Elet Unit} \]

NOTE: To subtract the zero reading (as is normally done), multiply the value to “-1”
EXAMPLE OF LINEAR CONVERSION (C=1)

INSTALLATION READING: 8961 [digit] “in our example we used the zero reading of the instrument calibration report”

<table>
<thead>
<tr>
<th>pressure [MPa]</th>
<th>readings [digit]</th>
<th>statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>avg [digit]</td>
<td>lin [MPa]</td>
</tr>
<tr>
<td>0.00</td>
<td>8961</td>
<td>8961</td>
</tr>
<tr>
<td>0.34</td>
<td>8285</td>
<td>8286</td>
</tr>
<tr>
<td>0.68</td>
<td>7607</td>
<td>7608</td>
</tr>
</tbody>
</table>

S (FROM SENSOR CALIBRATION REPORT): -2006.66974 [digit/MPa]

The fields on datalogger web page are configured as follows:

If data logger has to acquire a value of 7608 digit, the user will obtain this result:

\[
7608 \text{ digit} \cdot \left(-\frac{0.00049834}{\text{digit}}\right) + (4.465625 \text{ MPa}) = 0.6743 \text{ MPa}
\]

**Fields compilation on data logger**

Zero Reading [Z]:

\[
8961 \text{ digit} \cdot \left(-\frac{0.00049834}{\text{digit}}\right) = +4.465625 \text{ MPa}
\]

Zero reading (electrical reading) \(1 \frac{\text{digit}}{S}\)

Zero reading \(\cdot \frac{1}{S}\)

Sensitivity [C]= -0.00049834 [MPa/digit]

Please, notice that the “Sensitivity [C]”, in case of some sensors calibration report is “1/S” that is:

\[
\frac{1}{-2006.66974} = -0.00049834
\]
EXAMPLE OF LINEAR CONVERSION (C=1)

Installation reading: 8961 [digit]  “in our example we used the reading of the instrument certificate”
S (from sensor calibration report): -2006.66974 [digit/MPa]

<table>
<thead>
<tr>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear sensitivity factor</td>
</tr>
<tr>
<td>x</td>
</tr>
<tr>
<td>Z</td>
</tr>
<tr>
<td>C</td>
</tr>
</tbody>
</table>

Fields compilation on data logger

Zero Reading [Z]: -8961 (digit)  --- the zero reading in electrical unit is inserted
Sensitivity [S]: 1  --- the value 1 is inserted in order to NOT realized the conversion

The fields on data logger web page are configured as follows:

If data logger acquires a value of 8961 digit, that is identical to the zero reading, we will obtain this result:

\[(8961 \text{ digit} \times 1) + (-8961 \text{ digit}) = 0 \text{ digit}\]

\[X \times C + Z\]

If data logger acquires a value of 7000 digit, we will obtain the following result:

\[(7000 \text{ digit} \times 1) + (-8961 \text{ digit}) = -1961 \text{ digit}\]

\[X \times C + Z\]

"-1961 digit" is the difference between the zero reading and the actual reading.

POLYNOMIAL CONVERSION

The formula is expressed as follows:

\[AX^3 + BX^2 + CX + D - Ez\]

Where \(X\) is the actual reading in electrical unit.

- Selecting the entry “Polynomial” the following fields are enabled:
  - Poly.Coeff. A
  - Poly.Coeff. B
  - Poly.Coeff. C
  - Poly.Coeff. D
  - Zero Reading, Ez

- The polynomial coefficient of conversion are indicated on instrument calibration report.

<table>
<thead>
<tr>
<th>Polynomial sensitivity factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>Elat</td>
</tr>
</tbody>
</table>
EXAMPLE OF POLYNOMIAL CONVERSION WITH A 3rd DEGREE POLYNOMIAL

- In case the instrument certificate envisages a 3rd degree polynomial, the coefficients have to be compiled as follows:

  - Poly.Coeff. A: 2.597e-07
  - Poly.Coeff. B: -9.236e-06
  - Poly.Coeff. C: 1.096e-02
  - Poly.Coeff. D: -1.306e-01

EXAMPLE OF POLYNOMIAL CONVERSION WITH A 2nd DEGREE POLYNOMIAL

- In case the instrument certificate envisages a 2nd degree polynomial, the coefficients have to be compiled as follows:

  - Poly.Coeff. A: 0
  - Poly.Coeff. B: -1.960e-09
  - Poly.Coeff. C: -4.699e-04
  - Poly.Coeff. D: 4.368e+00
SUBTRACTION OF THE ZERO READING

To subtract the zero reading (or installation reading), in case of 3rd or 2nd degree polynomial conversion, do as follows:

- set up the polynomial coefficients as described in the previous pages
- do an acquisition with data logger. The read value is the installation reading, expressed in engineering unit.
- Fill the value in the field

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a “Basic Component” under 10 CFR 21 (NRC), used in or with any nuclear installation or activity, or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA’S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA’s policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

© Copyright 2016 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.
Where Do I Find Everything I Need for Process Measurement and Control?
OMEGA...Of Course!
Shop online at omega.com™

TEMPERATURE
- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE
- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL
- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY
- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION
- Communications-Based Acquisition Systems
- Data Logging Systems
- Wireless Sensors, Transmitters, & Receivers
- Signal Conditioners
- Data Acquisition Software

HEATERS
- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL
- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments