DIGITAL LINEARIZER
OC 7040A- POL

Owner's Manual

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Vor dem Einschalten

Überzeugen Sie sich, ob Ihre Sendung das richtige Gerät Orbit Controls Modell OC 7040A-POL beinhaltet, einschliesslich einer Betriebsanleitung OC 7040A-POL.
Vor dem Einschalten des Gerätes überprüfen Sie die Anschlüsse und die Versorgungsspannung. Ein falsch angeschlossenes Gerät kann beschädigt werden und damit auch die mitverbundene Folgeelektronik. Für falsche Handhabung wird jede Haftung abgelehnt.

ZU BEACHTEN

Dieses Gerät wurde sorgfältig verpackt. Falls es bei Ihnen in beschädigtem Zustand eintrifft, benachrichtigen Sie unverzüglich den Orbit Controls Kundendienst (Tel: +41 1 730 2753 oder Fax: +41 1 730 2783) und nehmen Sie einen Schadenrapport auf, welchen Sie auch von der Transportgesellschaft unterschreiben lassen. Bewahren Sie bitte das Verpackungsmaterial für eventuelle Reklamationen auf.

Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following:
Orbit Controls Model OC 7040A-POL Programmable Controller.
Operator's Manual OC 7040A-POL.
If you have any questions about the shipment, please call the Orbit Controls Customer Service Department.

NOTE

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the Orbit Controls customer service, Phone +411 730 2753 or Fax +411 730 2783 and to the shipping agent.
The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in event the reshipment is necessary.

INDEX

PROGRAMMABLE DIGITAL LINEARIZER
OC 7040A - POL

- ✓ **6 Digit Display ± 999999**
- ✓ **± 100 000 Measuring Increments**
- ✓ **Input 4-20mA, 0-1V, 0-10V**
- ✓ **Strain Gauge 20mV**
- ✓ **Polynom 6the Degree**
- ✓ **Free programmable**
- ✓ **Four Set Point Relays**
- ✓ **RS 232 and RS 485**
- ✓ **Isolated Excitation**
- ✓ **Output 0/4-20mA, 0-10V**

OC7040A-POL is a programmable 6 digit instrument with inputs for process signals such as 0-20mA, 4-20mA, 0-1V, 0-10V, -1V...+1V und -10V...+10VDC and 20mV Strain Gauge Applications. The display can be scaled in required process units like kg, gr, lb, kN etc. Isolated excitation is available for supplying of external sensors. Output options Set Points, Analog Outputs and Serial Data Ports are suitable for control applications.

The instrument can be used for measuring of linear and non-linear signals. The non-linear signals can be linearized with a polynom of sixth degree.

Linear Signals can easily be calibrated with the keyboard to the desired display values. The Minimum and the Maximum of the input signal will be assigned to the Minimum and the Maximum of the display reading, such as 4 - 20mA at the input will appear at the display as 0 - 25000.

Linearizing with a Polynom sixth degree uses 6 digit Coefficients with decimal point and sign and Exponents settable between 0 and ± 24.

The Menu of the instrument can be entered with the keyboard or serial data port and contains four Set Points with hystereze, selection of the Input Range, Linearizing functions, Filter, Tara, two Analog Outputs, Sampling Rate, Display Count and Serial Data Ports.

Four Set Points can be set within the entire display range 0…± 999999. They activate four output transistors or four mechanical Relays. The hystereze can be individually programmed.

Input is designed for signals 0 ... ± 1V, 0 ... ± 10 V or 0/4-20mA. For Strain Gauge applications a programmable range is also available.

Linearizing with a Polynom of 6th degree can be activated in the menu. The polynom is of 6th degree with 6 digit Coefficients with decimal point and sign and Exponents programmable from 0 and ± 24.

Digital Filter with averaging function has selectable constants from 1 to 99. The filter can be deactivated in the menu.

Tara can be selected in the menu and activated with the keyboard. The Tara remains stored also when the instrument is switched-off from the supply. The Tara can easily be set with the key SET forcing the display to zero. When the key SET is pressed for a second time, the display returns to show the non-tara signal.

Analog Outputs 0 ... ±10V and 0/4-20mA are generated simultaneously and can be assigned with the keyboard to any two desired display values.

Sampling Rate is selectable from 1 to 30. The selected value determines the number of measurements after which the display will be refreshed with new information. By selection of 1 the display will be refreshed 15 times per second.

LSD Count can be set for 1, 2, 5 or 0. These numbers correspond to the reading of the Last Significant Digit of the display. When 1 is selected, the LSD reads all numbers between 0 and 9. When 2 is selected, the LSD reads only even numbers. With 5 the LSD reads 0, 5, 0, 5… When 0 is selected, the LSD displays dummy zero.

Peak Memory can be used for displaying of the Maximum and the Minimum display reading during the determined measuring period. With the keyboard the values can be recalled at the display or erased upon demand.
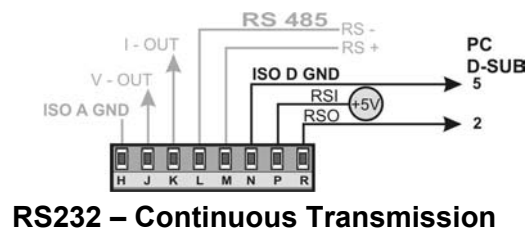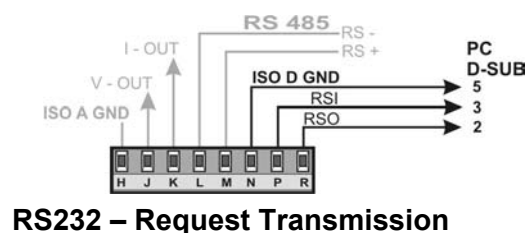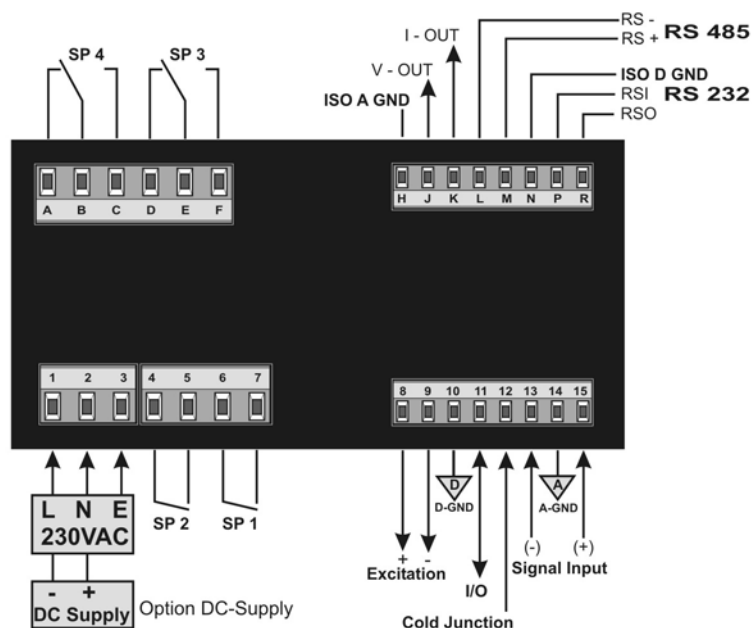
Two Serial ports RS232 and RS485 are optionally available. The RS485 data port has a programmable address which permits the instrument to operate on an addressable data bus.

1   SPECIFICATIONS

Display: 0 ... ± 999999, 7 segment red LED, 14.7mm with decimal points.

Input: The input is configured upon the customer order for DC or AC voltage or current,
                RTD or Thermocouples, Potentiometers, Resistors or Strain Gauge.

Voltage	± 100mV to 300V DC or true RMS.	
	20mVDC for Strain Gauges	
Current	0/4-20mA, ±20mA to 5A DC or true RMS.	
Pt-100/200	2 or 4 wire termination. Range -200...+650°C according to PT385.	
OHM	10Ω-100k Ω, 2 or 4 terminals	
T/C	E, J, K, S, B, C, T according to DIN.	
	Cold Junction compensation 0 - 60°C at the terminals.	
Thermistors	96255Ω @ 0ºC, 2034Ω @ 100ºC	

ADC: 19 Bit, bipolar, Sampling Rate 63ms.
Integral Nonlinearity: ± 0.006% from range
Zero Error: ± 0.0168% from range
Rollover Error: ± 0.032% from range
Tempco: ±10ppm°C
Linearity: ± (1 LSB + 1 Digit).

Accuracy

DC Ranges	± (0.01% from value + 2 digits)	
True RMS	50Hz - 5kHz:	± (0.1% from value + 2 digits).
Pt-100 und T/C	*Pt-100/200:*	±(1°C+1 digit)
	T/C, Thermis:	±(2°C+1 digit)
	Tempco:	±25 ppm/ °C.

Set Points: Standard: Mechanical Relays SP1, SP2, rated for 5A-230VAC
                Option: Additional two Relays SP3, SP4 rated for 5A-230VAC
                           All programmable within the entire display range ± 999999.
                           Each Set point has an individual hystereze selectable between 0 and 99.

Analog Output: Option: Analog Outputs 0/4-20mA and 0...±10V with 12 bit resolution (Option 16 bit).
                           Isolation 250V RMS.

Data Ports: Option: RS232 and RS485 with address 01-31, 8 bit, 1 start, 1 stop, no parity.
                           Baud rate 600 … 19200 bd, isolation 250V RMS.
                           RS232:   continuous or request transmission is selectable.
                           Continuous: Terminal P (RSI) to be wired to +5V in respect to N (GND).
                           Request: Terminals P (RSI), R (RSO) and N (GND) to be connected with the
                                              D-SUB of the PC with terminals 2, 3 and 5 - page 7.
                                              The data are requested with <CR> <LF> (ENTER).

Excitation: Isolated supply for external sensors adjustable from 5 to 24V/40mA.

Current Out: 1mA constant current source for RTD and Resistor measurements

Supply: 115V / 230V ±10%, 48-60 Hz. Option 9-36VDC-4W.

Cabinet: DIN 48x96x100 mm (H x B x T), Panel Cut-Out 45 x 90 mm. Coverage: IP65 at the front

Terminals: Pluggable screw terminals

2   TERMINALS
2.1   REAR Panel of the instrument

RS232 – Request Transmission

RS232 – Continuous Transmission

2.2   Option Card

Two analog outputs, two serial data ports and four set point relays are optionally available. The option card is placed in the upper part of the cabinet. The card contains two analog outputs 4-20mA and -10…+10V and two data ports RS232 and RS485. Potentiometers P1, P2, P3, P4 are intended fort he calibration, which is described in the Service Menu - HTEST (§ 10).

ANALOG OUTPUT CALIBRATION
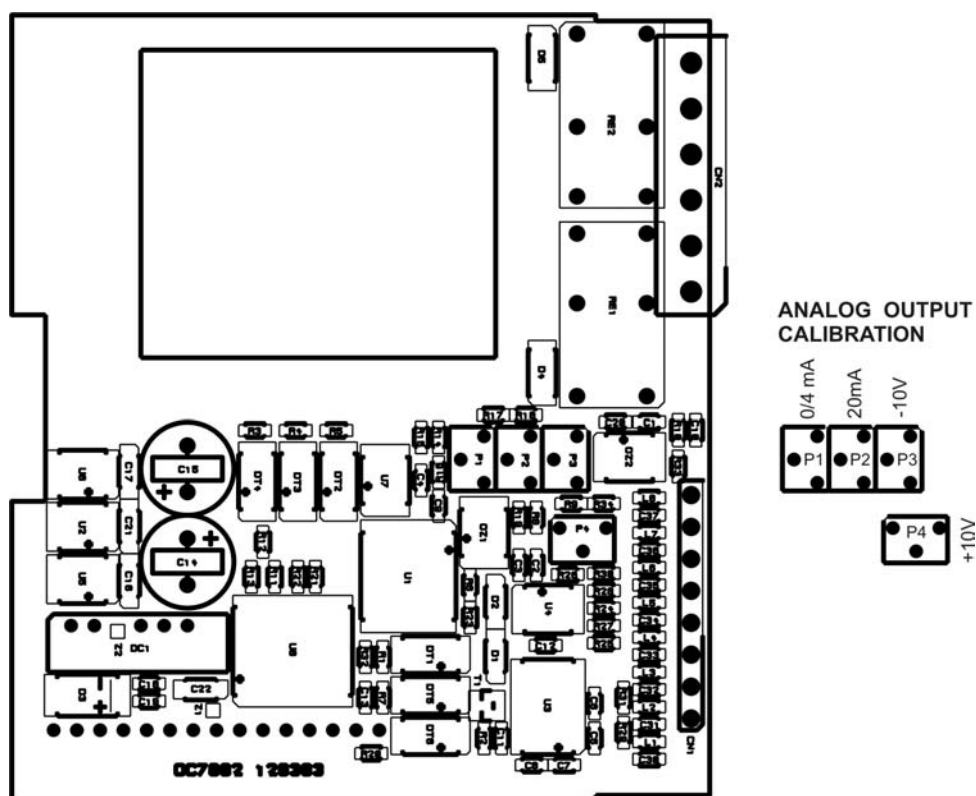
2.3   Serial Ports RS232 and RS485

The Baud Rate can be set in the menu Step *bAUd* with keys UP or DOWN, the address in *rS Adr*.
The address 00 automatically activates RS232.
One of addresses 01 ... 31 activates RS485.

Data Format: 8 bit, No Parity, 1 Start und 1 Stop, Baud Rate 1200 to 19200.

The terminals are L, M (RS485) and N, P, R (RS232) at the rear of the instrument.
RS232:   continuous or request transmission is selectable.
              Continuous: Terminal P (RSI) to be wired to +5V in respect to N (GND).
              Request: Terminals P (RSI), R (RSO) and N (GND) to be connected with the
                                    D-SUB of the PC with terminals 2, 3 and 5 - page 7.
                                    The data are requested with <CR> <LF> (ENTER).

In the Request Mode the PC sends two bytes. The first byte is the **address**, the second is **D**. The instrument answers with data string terminated with *<CR> <LF>*. The address consist of a number 128 + the address selected in the instrument (1 … 31). For an instrument with address 1 the first byte will be 129 (128 + 1). The second byte **D** is 44H = 68D.

2.4   Analog Outputs

Two Analog Outputs -10V ... +10V and 0/4 ... 20mA are generated simultaneously. They can be assigned with the keyboard to any two display values.
The required display reading for the analog output -10V and 0/4mA will be set in the menu step *Aout L*.
The reading for +10V and 20mA will be set in the menu step *Aout H*.

2.5   Relay Outputs

Four Set Point SP! … SP4 activate four transistor outputs or four mechanical relays. Each Set Point has a programmable Hystereze and Function. The parameters can be set in Menu Steps *SP 1*, *HSt 1, FnrL1* to *SP 4*, *HSt 4, FnrL4*. The function *FnrL1* to *FnrL4* permits the Set Point to be activated or deactivated in the alarm condition (Open or Closed).

3   KEYBOARD

◉	**MENU**
◀	**ACK**
▲	**UP**
▼	**DOWN**
▼	**SET**

1,2,3,4 activated Set Points

P   Program Mode

The key **MENU** opens the menu. The required parameter will be confirmed with **ACK** and set with **UP** or **DOWN**. The flashing digit - Cursor - can be positioned with **ACK**. The sign and the decimal point can be set when the cursor is moved out of the display range and no digit is flashing. The decimal point can be set with **UP** the sign with **DOWN**.

The programming is terminated with **SET** and the display returns to measuring mode.

4   ASSIGNEMENT of the INPUT SIGNAL to DISPLAY

Linear Signals   will be assigned in menu Steps *SEt LO* and *SEt HI* to required display readings. The low value of the input signal will be assigned in *SEt LO* to the minimum display reading. The maximum input signal value will be assigned in *SEt HI* for the required maximum display reading.

Non-linear Signals   which are described with a polynom, have the *SEt HI* and *SEt Lo* values calculated from the polynom – see POLYNOM LINEARIZING (§ 6).

5   MENU STEPS

The text bellow shows the full menu with all options installed. If one or more options are not installed, the corresponding menu Step is suppressed in the menu. The key MENU permits the entry into the menu and scrolling the parameters at the display. The required menu step will be confirmed with ACK. The Cursor (flashing digit) can be moved with ACK and set with UP or DOWN to required value.

Key	Display	Function
MENU	OrdEr	Display resolution, active decimal point
ACK	CCCC.dd	Select with UP or DOWN
MENU	Fn tArA	Activation of Tara-Function:
ACK	ONLY	after pressing the key SET the display will reset to zero
	ON	pressing SET for first time the display resets to zero. The display returns to follow the non tara signal when SET pressed for second time.
	OFF	Tara deactivated
MENU	FiltEr	Filter constant (averaging filter type):
ACK	OFF	Selection: OFF and 1, 2….99
MENU	Count	Count of the LSD:
ACK	0	Dummy Zero
	1	All increments 1, 2, 3….9, 0
	2	Even numbers only 2, 4, 6…
	5	Increments 0, 5, 0, 5… only
MENU	dSP	Refresh of the display reading:
ACK	1	Selection from 1, 2 …. 50
MENU	SP 1	Set Point SP1
ACK	XXXXXX	Selection: -999999 to 999999. The SP1 will be activated when the display arrives at the set point or is larger than the set point value selected.
MENU	HSt 1	Hystereze SP1
ACK	XXXXXX	Selection: -999999 to 999999
MENU	FnrL1	Function of the SP1
ACK	OPEN	Selection between OPEN and CLOSE when the Set Point is activated

Same menu Steps for the Set Point SP2, SP2 and SP4

MENU	Aout L	Display value for Analog Output 0 (-10) V and 0/4mA
MENU	Aout H	Display value for Analog Output 10V and 20mA
		The outputs 0 or 4mA and 0V or -10V can be selected at the Option Board.
MENU	SEnS	Selection of the Input Type
ACK	LinEAr	DC and AC voltages and current, process signals
	POLYn	Polynom Linearizing
	Pt 100	RTD Resistance Thermometer
	TC E	Thermocouple E with automatic cold junction compensation
	TCC E	Thermocouple E with external cold junction compensation
	TC J	Thermocouple J with automatic cold junction compensation
	TCC J	Thermocouple J with external cold junction compensation
	TC L	Thermocouple K with automatic cold junction compensation
	TCC L	Thermocouple K with external cold junction compensation
	TC S	Thermocouple S with automatic cold junction compensation
	TCC S	Thermocouple S with external cold junction compensation
	TC b	Thermocouple b with automatic cold junction compensation
	TCC b	Thermocouple b with external cold junction compensation
	TC t	Thermocouple t with automatic cold junction compensation
	TCC t	Thermocouple t with external cold junction compensation
	Cold	Cold junction temperature measured by internal compensating sensor
MENU	Set in	Signal polarity selection
ACK	0.0 1	For bipolar signals without offset such as 0...20mA
	0.2 1	For bipolar signals with offset such as 4-20mA
	-1 1	For bipolar signals such as -20V ... +20V
MENU	Set LO	Required Display for minimum input signal
MENU	Set HI	Required Display for maximum input signal

When with ACK the Polynom Linearizing is selected, six coefficients will be accessed in the menu

ACK	CoEF 0	Coefficient 0
MENU	CoEE 0	Power of Coefficient 0
MENU	CoEF 1	Coefficient 1
MENU	CoEE 1	Power of Coefficient 1
MENU	CoEF 2	Coefficient 2
MENU	CoEE 2	Power of Coefficient 2
MENU	CoEF 3	Coefficient 3
MENU	CoEE 3	Power of Coefficient 3
MENU	CoEF 4	Coefficient 4
MENU	CoEE 4	Power of Coefficient 4
MENU	CoEF 5	Coefficient 5
MENU	CoEE 5	Power of Coefficient 5
MENU	CoEF 6	Coefficient 6
MENU	CoEE 6	Power of Coefficient 6
MENU	bAUd	Baud Rate of the data port
ACK	1200	Selection from 1200 to 19200 bd
MENU	Contin	Type of transmission
ACK	OFF	On = Continuous, OFF=Request
MENU	rS Adr	Address of the Port
ACK	rS 232	RS232 activated (Address 00)
	31	RS485 activated (Addresses 01 … 31)
MENU	Start	Measuring Mode

6   POLYNOM – LINEARIZING

The Polynom-Linearizing will be activated in the Menu. A polynom of sixth degree can be used.

The Polynom contains 7 coefficients: **coef0 cee0** to **coef6 coee6**, whereas the Index is the Exponent which multiplies the measured value. It will also be multiplied by a tenth power which is entered as **coee**. The coefficients have 6 digits with decimal point and sign, the exponents can be set from 0 to $\pm$ 24.
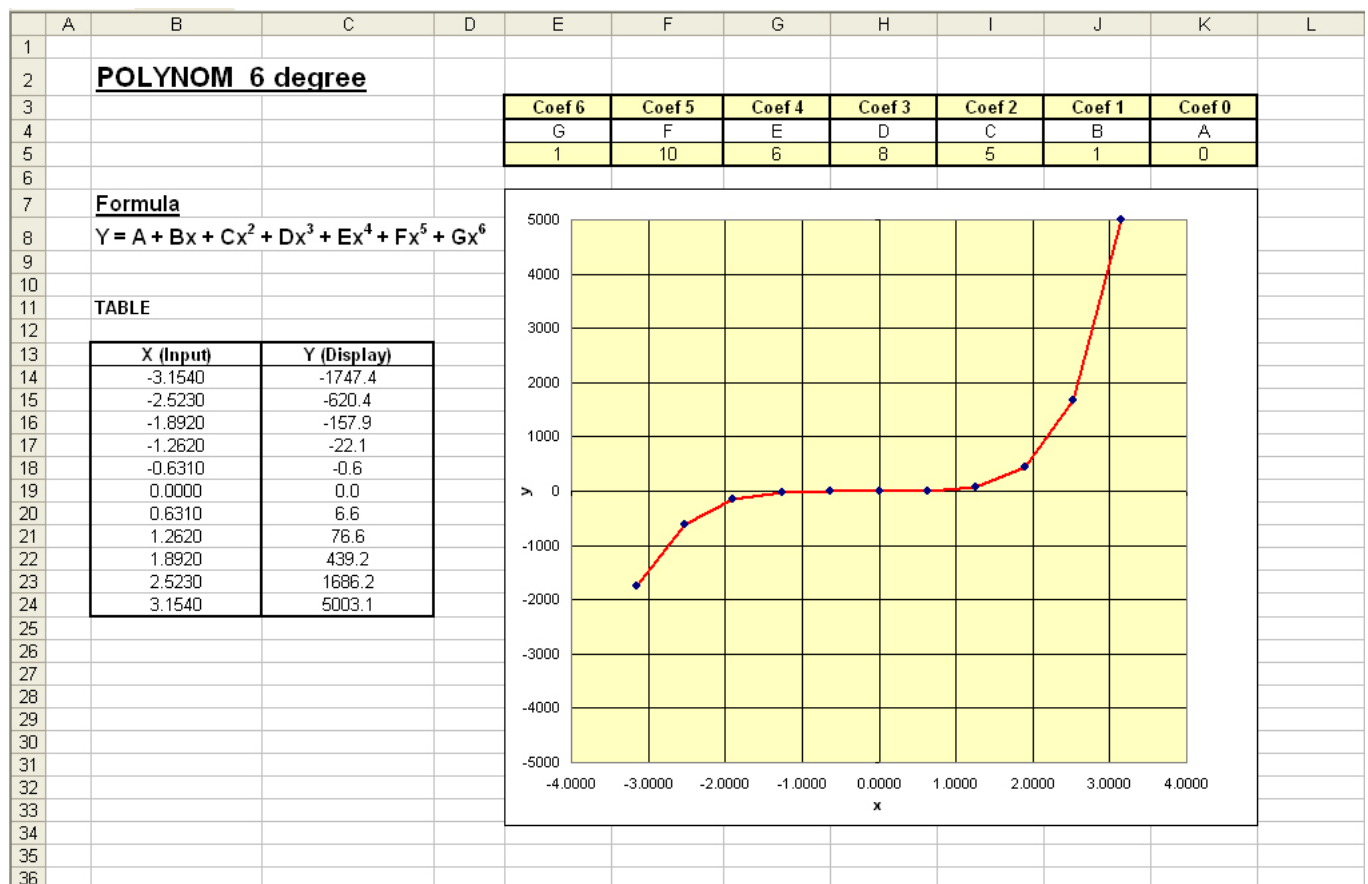
The entry can be done with the keyboard or via the data port. The display follows the input signal in a format:

DISPLAY $= \pm$ Coef 0x10$^{\pm 0}$ $\pm$ Coef 1x10$^{\pm 1}$ $\pm$ Coef 2x10$^{\pm 2}$ $\pm$ Coef 3x10$^{\pm 3}$ $\pm$ Coef 4x10$^{\pm 4}$ $\pm$ Coef 5x10$^{\pm 5}$ $\pm$ Coef 6x10$^{\pm 6}$

Example:

$$Y = 5000 = 0 + 1X^1 + 5X^2 + 8X^3 + 6X^4 + 10X^5 + 1X^6 \qquad \text{(see Fig. bellow)}$$

The result **X** of this polynom is: **X = 3.154**. This value will be inserted in the menu step **Set Hi**.

12

7   INPUT RANGES

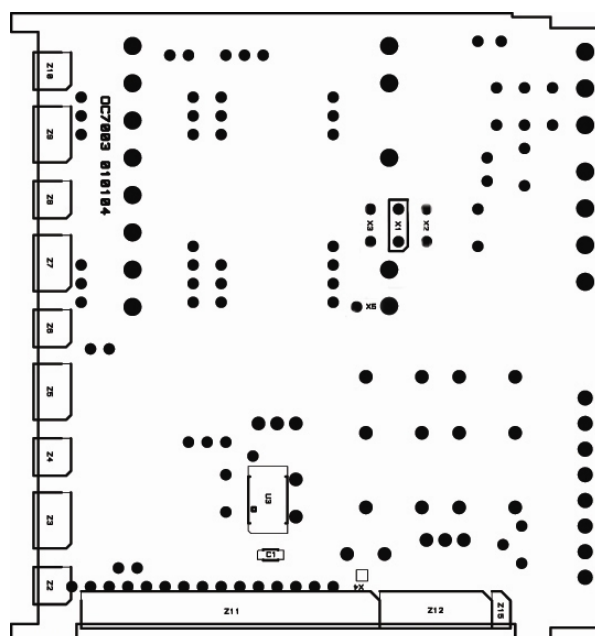| Jumper	20mA	1V	10V	100V	10mV-1V
H1	1+2	1+2	2+3	2+3	1+2
H2	1+2 = DC 2+3 = AC	1+2 = DC 2+3 = AC	1+2 = DC 2+3 = AC	1+2 = DC 2+3 = AC	1+2 = DC 2+3 = AC
H3	1+2	---	---	2+3	---
R19 (page 14, § 9.3)	open	open	open	open	R=50k/G-1
Input single ended	(+)15, (-)14,13	(+)15, (-)14,13	(+)15, (-)14,13	(+)15, (-)14,13	(+)15, (-)14,13
Input differential	---	(+)15, (-)12	---	---	(+)15, (-)12
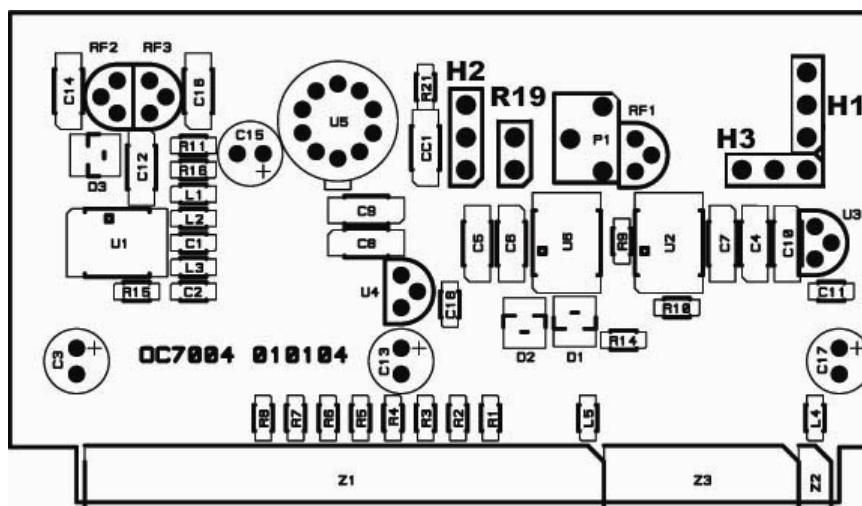
8   AC - SUPPLY

115VAC solder blobs X2, X3
    X1 = open
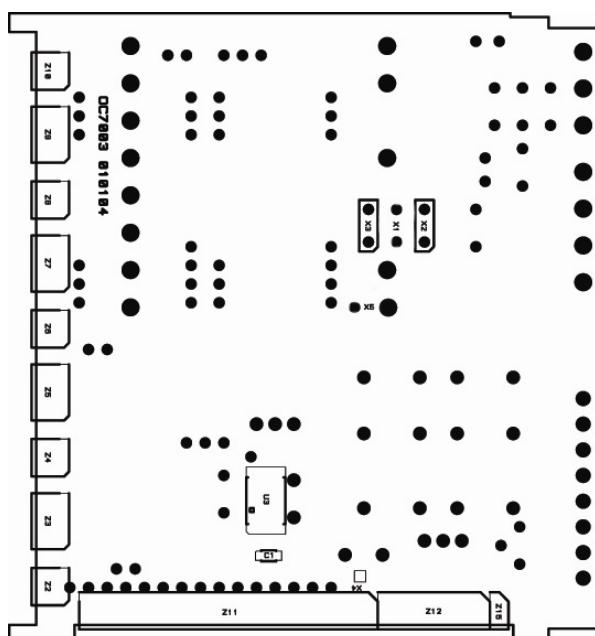
230VAC solder blob X1
    X2 = X3 = open

9 CALIBRATION

9.1 Calibration of linear signals DC and AC
The calibration of linear signal such as 4-20mA, 0-1V is described in § 10, **Service Menu-*HtESt***.

9.2 Calibration of non-linear signals (Tables)
Following is the calibration of non-linear signals derived from internally memorized function tables:

9.2.1 Calibration of Pt-100 Thermometers

Jumper	Pt-100
H1	1 + 2
H2	1 + 2
H3	---
R19	26k7 Resistor 1%

SEnS   LinEAr
Set LO   0
Set HI   313.65   (313.65 Ohm = 600ºC)
          Calibrate In HtESt with 0 Ohm and 313,65Ohm.
          After calibration switch-off and switch-on again.

SEnS   Select Pt 100 in the Menu.

Press the key ACK to switch into measuring mode. The Display reads the temperature from -200 to 600ºC.

9.2.2 Calibration of Thermocouples

Jumper	Thermoelemente
H1	1 + 2
H2	1 + 2
H3	---
R19	5k6 Resistor 1%

SEnS   LinEAr
Set LO   0
Set HI   100   (100 = 100 mV)
          Calibrate in the HtESt with 0 mV and 100mV.
          After calibration switch-off and switch-on again.
SEnS   Select the T/C function in the Menu.

Press the key ACK to switch into measuring mode. The Display reads the temperature.

Cold junction is compensated with external sensor SMT160 at the terminal block.

9.3 Calculation of R19 (see table at page 13)

The correct range can be checked during the calibration in the service mode ***HtESt*** -§ 10. When zero input signal is applied, the display has to show the reference voltage is 1.25xxx. With the maximum at the input the display shall not exceed 2.50V. It is recommended to design R19 in a way that the display shows 2.2xxxx with maximum input signal. There still remain 10% reserves for overrange.

$$R19 = \frac{50\text{kOhm}}{G - 1}$$ **G = Gain**

10   SERVICE MENU - HtESt

The service menu **HtESt** permits checking of the display, setting of optional parameters and calibration of the signal channel. The service menu will start when the key **MENU** is kept pressed while the power is switched-on. The test of the display segments is performed, the HCF parameter can be set (see bellow) the signal channel can be calibrated, the Set Points activated and the Analog Output signals generated. With the key **MENU** the menu steps are incremented, with **SET** decremented.

Segments   all display segments illuminated

HCF.128   HCF-Parameter determines the range of the main menu. HCF.128 will be set for instrument without options (Analog Output, Set Points and RS ports). Each option is described with a binary code:

1	SP1
2	SP2
4	SP3
8	SP4
16	Analog Output
32	Baud Rate
64	Address of the Data Port

Combinations determine the menu range:

HCF.144   Menu (128) plus Analog Output (16).

HCF.240   Menu (128), Analog Output (16), Baud Rate (32) and Address (64).

AdC   ADC internal value of the input signal.

        CAUTION! <u>Set zero at the input prior entering this step!</u>

1.25XXX   Apply zero signal to the input. The display will show the internal voltage reference 1.25V. <u>Zero value</u> can now be calibrated when the key **DOWN** is pressed. The display will show *Ac LO*. Press the key **ACK** until the display confirms memorizing of this step by *EE StO*. The zero value has been calibrated.

2.2XXXX   <u>Maximum value</u> can now be calibrated. Apply the maximum signal, press the key **UP**. The display will show *AC HI*. Press the key **ACK** until the display confirms memorizing of this step by *EE StO*. The maximum value has been calibrated.

rES   The display shortly shows *rES* and switches into internal measuring mode. The display corresponds to the value set in the menu step **Set HI** of the main menu.

|	
SP1	Set Point 1 activated.
SP2	Set Point 2 activated
SP3	Set Point 3 activated.
SP4	Set Point 4 activated
An - 10	Analog Output -10V und 0/4 mA generated (0 or 4mA selectable).
An - 5	Analog Output -5V and 5/8 mA generated.
An 0	Analog Output 0V and 10/12 mA generated.
An 5	Analog Output 5V and 15/16 mA generated.
An 10	Analog Output 10V and 20 mA generated.
StArt	Measuring Mode

11 EXAMPLES
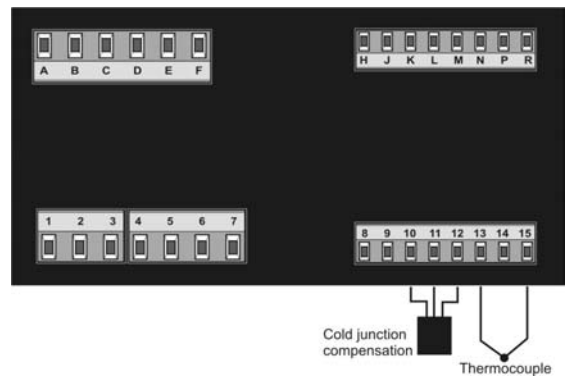
11.1 Process Signal 0/4-20mA
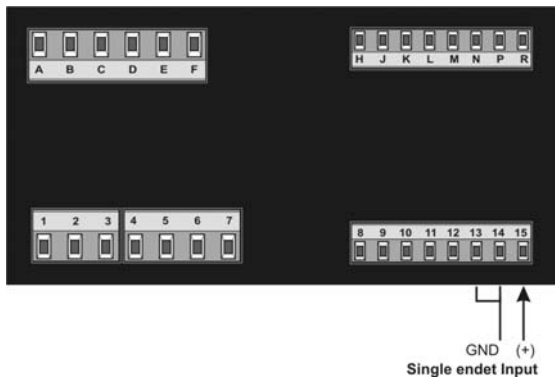
11.2 Two Terminals Sensor
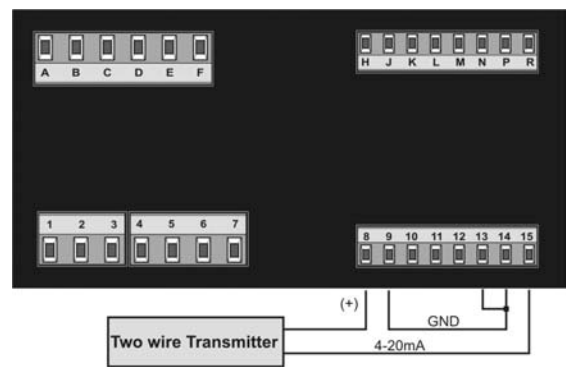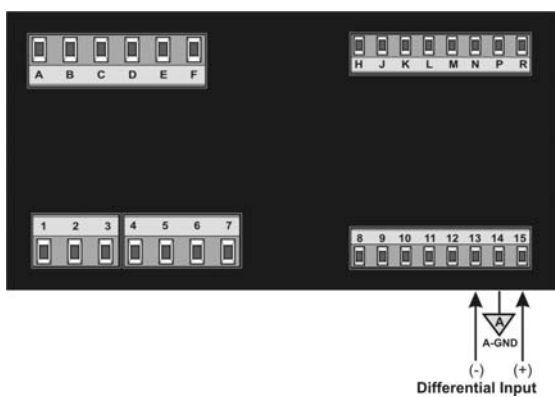

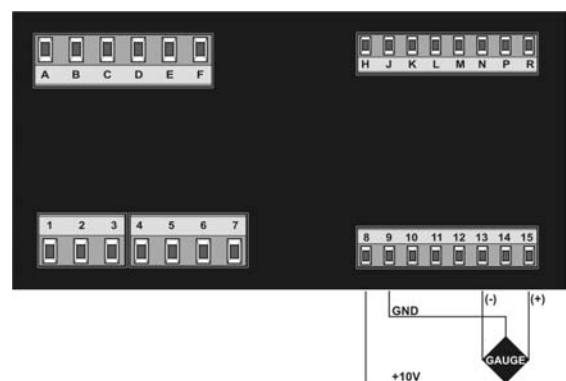## 11.3 RTD Thermometer and Ohmmeter
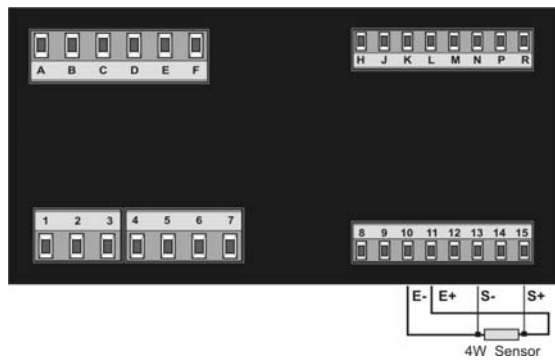
11.4 Thermocouples and Thermistors

11.5 Differential Inputs

11.6 Strain Gauges
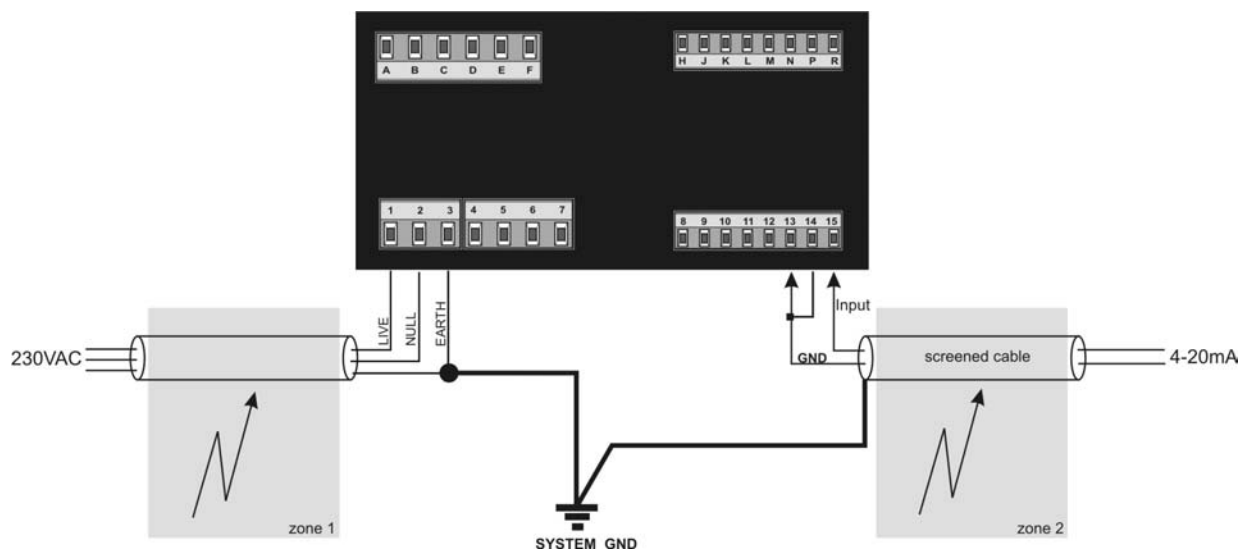

16

12   BURST TEST and RECOMENDED GROUNDING

Tester: Burst-Surge Generator HILO, Model CE-Tester
E.U.T.:   OC7040, SN: 980315, Supply 230VA
                  Mode: Linear, Set LO = 000000, Set HI = 10000
                  Input: 4-20mA
                  Display: 10 000

12.1   Test Conditions
According to: IEC 801-4
                    IEC 1000-4-4
                    EN 50052-1

12.2   Test Set - Up

12.3   Test Results

Zone 1:   2kV Burst   Display 10 000 without change
Zone 2:   2kV Burst   Display 10 000 without change

CE Approval No: 321/30-3/539, c.j. 9004/69 from 15.6.1998 VTUE Praque