Nokeval

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Manual

Programmable signal converter 6740

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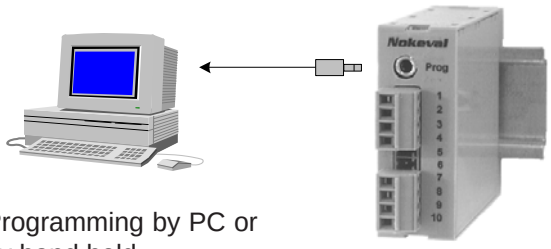
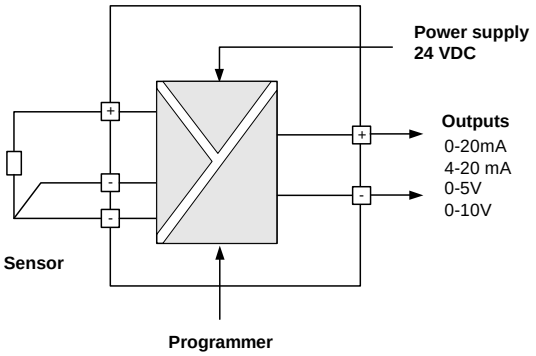
6740



Programming by PC or
by hand held
programmer 6790



6790

General description:

Signal converter 6740 is exceptionally versatile and accepts almost all common sensor inputs. You can configure it with a PC. Transmitter front side has configuration connector which connects adapter cable POL-RS232 to serial port of the PC. Menu based configuration program is easy to use. By hand held programmer 6790 you can easily control or configurate the transmitter in field conditions. The 16 bit A/D converter enables high accuracy. Linearity of A/D converter is 0.005 % and conversion accuracy of output signal is 0.05 %, without sensor linearization error. Galvanic isolation is specially important with thermocouples but potential differencies with other measuring circuits can be avoided also in case of process input signals. Small size converter is provided with detachable connectors which speed up installation and programming. Large sensor selection and other inputs as well as versatility reduce stocking costs significantly because the 6740 suits for most measuring applications.

Manufacturer:
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Technical specification:

Thermocouples:

Sensor	Range	Linearity		
E	-100.... 900°C	< 0.2°C	-50.... 900°C	
J	-150.... 900°C	< 0.2°C	-50... 900°C	
K	-150.... 1350°C	< 0.2°C	-40... 400°C	(<1°C > 400 °C)
L	-100.... 900°C	< 0.4°C	-50... 900°C	
T	-150... 400°C	< 0.2°C	-150... 400°C	
N	0....1300°C	< 0.2°C	0.... 1300°C	
R	0....1700°C	< 0.3°C	400.... 1700°C	(<1°C < 300 °C)
S	0....1700°C	< 0.3°C	300.... 1700°C	(<1°C < 300 °C)
C (W5)	0....2200°C	< 0.3°C	400.... 2200°C	(<0.4°C< 400 °C)
D (W3)	0....2200°C	< 0.3°C	500.... 2200°C	(<1°C < 500 °C)
B	400... 1700°C	< 0.3°C	400.... 1700°C	
G (W)	1000.. 2200°C	< 0.4°C	1000... 1700°C	(<3 °C >1700 °C)
Range selection		freely selectable		

Calibration accuracy	< 0.1 % of span
Cold junction compensation	< 0.05 °C /°C
Sensor wire influence	< 10kΩ, negligible

RTD's Pt100:	Pt100 3- or 4-wire connections,
Other RTD's	Pt500, Pt1000, Ni100, Ni1000
Range	-200....+700 °C (Pt100, Pt250, Pt500)
	-200....+200 °C (Pt1000)
	0.....+175 °C (Ni100, Ni1000)
Sensor current	0,3 mA
Calibration accuracy:	0.05% of span
Linearity	< 0.05 °C (-200..700°C)
Sensor error correction	freely offset selection
Other RTD's	0-1000 Ω, Potentiometer 50-500 Ω

Potentiometer input:	
range	3-wire connection 50-500 Ω
	2-wire connection 2-wire 0-1000 Ω
mV inputs:	-100...+100 mV
Accuracy	0,02% of span
Input impedance	>10 MΩ
Linearity	0,02% of span

Process inputs:	0..20 mA, 4..20 mA, 0..5 V, 0..10 V,
	-10...+10V
Input impedance	Current: 5 Ω and voltage: 1 MΩ
Accuracy:	0.02% of span
Linearity:	0.01% of span

IR-sensors	Exergen 140F-K (60°C) and 440F-K (220°C)
Range 140F-K	-40..+350 °C (linearized range)
Range 440F-K	-30...+600°C (linearized range)
Emissivity	selectable by PC or hand held programmer

Output:

Output	0..20, 4-20 mA, 0..5, 0..10 V
Output scaling	scaling on whole range, straight and reversed
Resolution	< 0.03 % of span
Output limiter	24 mA
Sensor break monitoring	3.5 or 24 mA or >10 V
Output load	<600 Ω for current and >10 kΩ for voltage

Configuration:

Connection	2-pole Nokeval POL-connection (transmitter)
Serial data	RS232, 1200, 9600 bps
Serial protocol	Meku 1

General:

Power supply	24 VDC ±15%
Power consumption	max. 40 mA
Temperature effects	<0.003%/°C
Galvanic isolation	1000 VDC/ 1 min.
Measuring rate	4 samples/s.
AD-converter	16 bit
Output DAC	12 bit
Operating temperature	0..60 °C
Ambient storage	-20....+70 °C
Humidity (non -condensing)	0..95 %RH
Weight	80 g
Connection	1.5 mm², AWG 16

How to order:

Type **6740 - Pt100 - 0/600 - 0/10**

Model
Sensor input
Range
Output

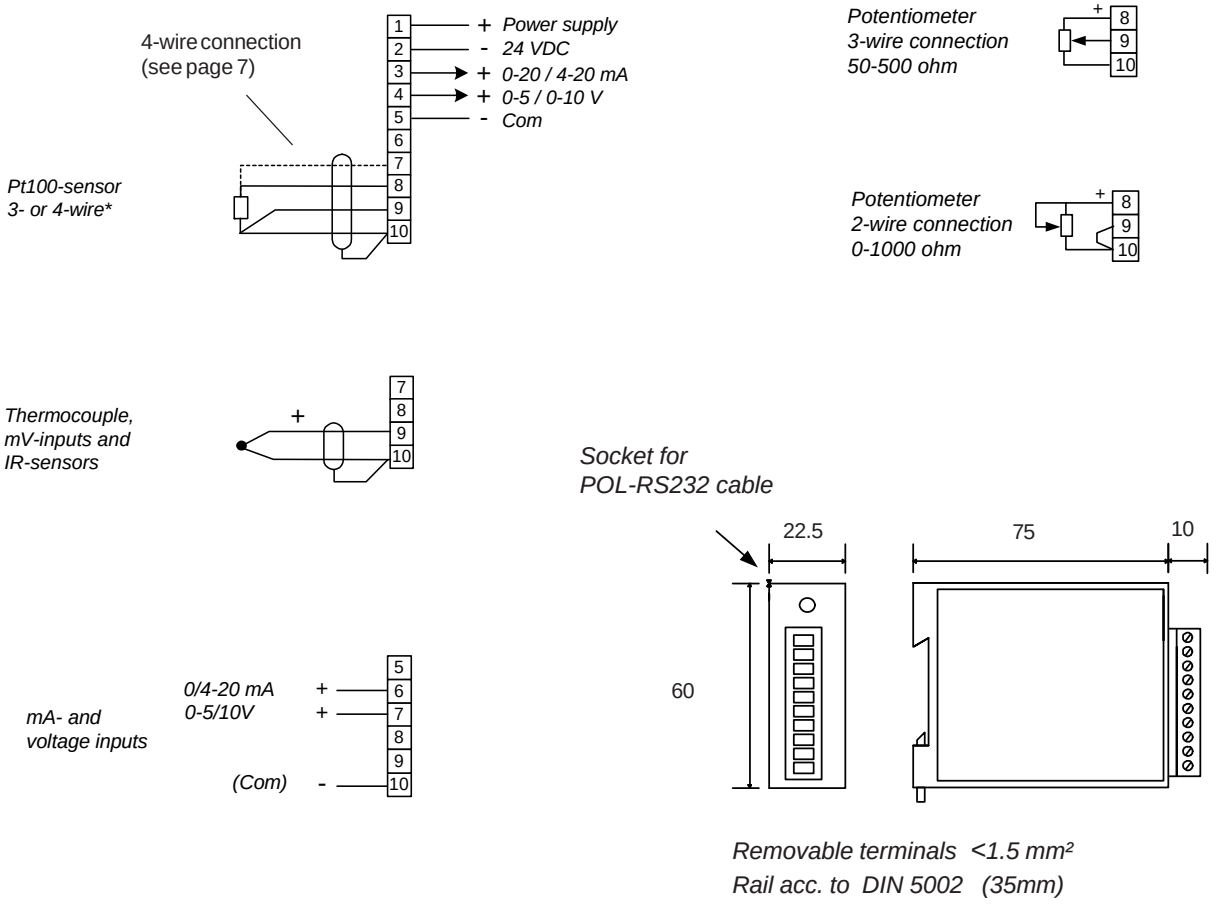
Example: 6740-Pt100-0/600, sensor: Pt100, range 0..600 °C, output 0..10 V

Transmitter is freely programmable but if you like it factory configured use above mentioned marking procedure.

Optional:

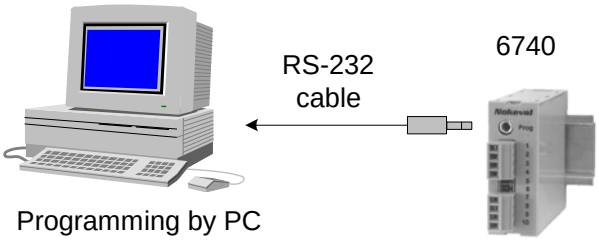
Cable for transmitter/PC	POL-RS232
Configuration software	MekuWin
Hand held programmer	6790

Connection and dimensions:



Programming

Transmitter programming is simple by using menu based configuration program MekuWin with PC or by hand held programmer 6790, connected to transmitter front plug socket Prog. Transmitter is connected to PC serial port with a serial signal cable POL-RS232.



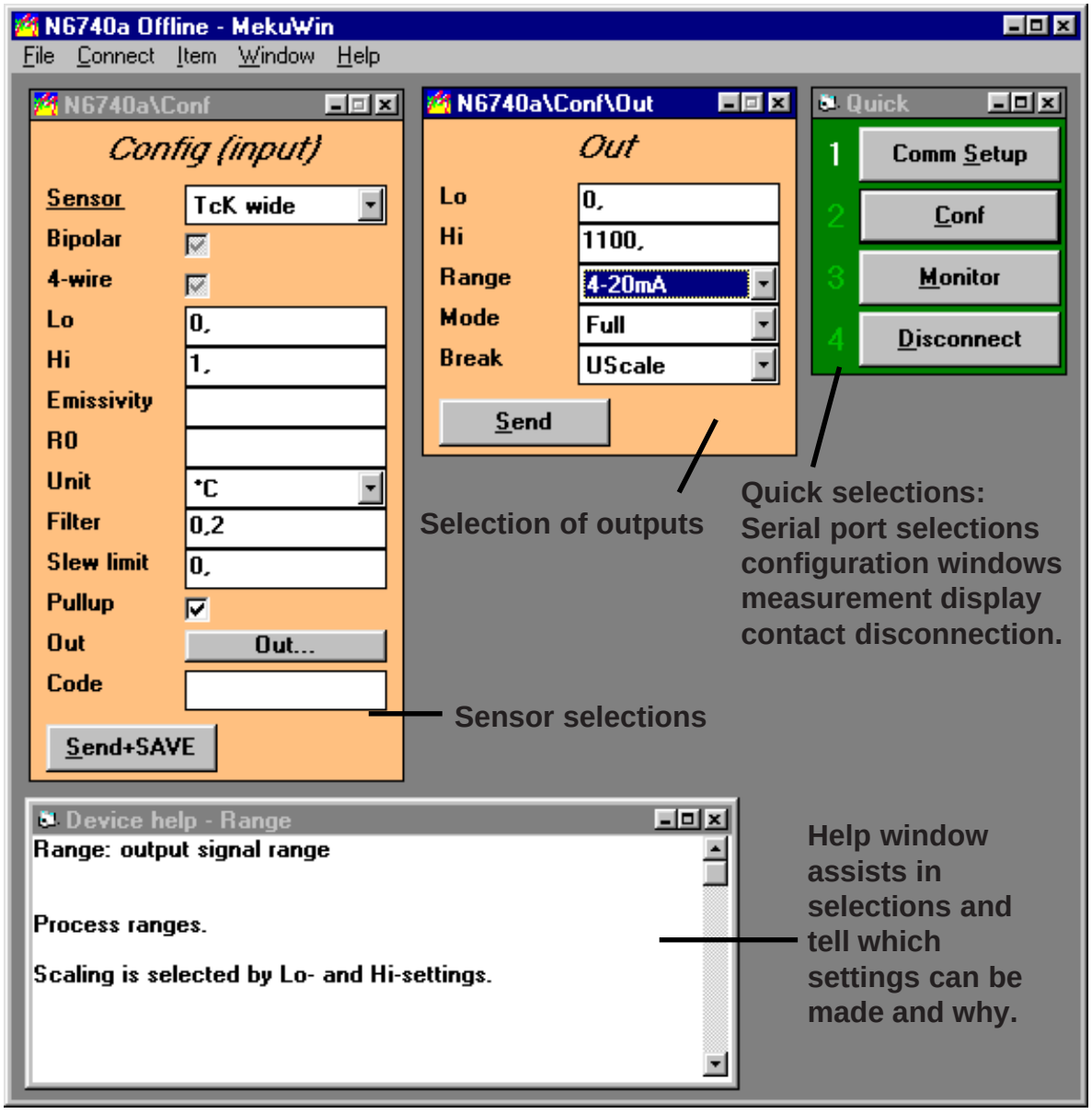
Programming by PC

By MekuWin-configuration program you may select sensor type and range, input filtering and max. conversion speed of output. In addition, you can correct sensor errors by shifting zero level or by changing input range. MekuWin is available for download at www.nokeval.com.

Hardware requirement :
PC at least 486, 16Mb RAM
Operating system Windows 3.11,
Windows 95/98

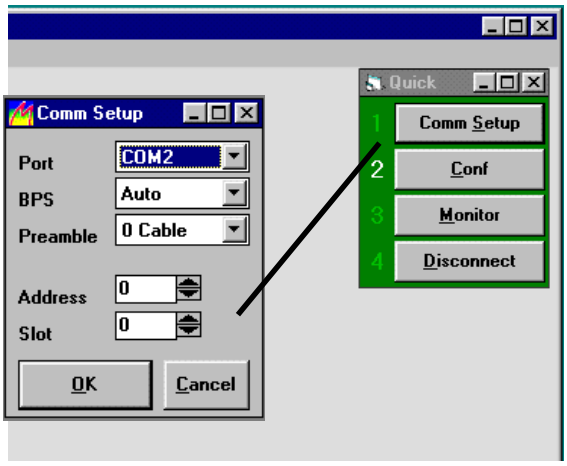
Configuration program MekuWIN

MekuWin is configuration program by which you can configure several Nokeval transmitters (Meku-protocol). This program differs from convential programs because it does not include setting commands, which are always loaded from device to be configured. The big advantage of this method is that you do not need to update the program when you later add on new functions or new transmitter models. The same configuration program suits for several transmitters.



Programming start:

Connect transmitter to PC serial port with adapter cable POL-RS232. Do not forget to supply 24 V to the transmitter.



When you start MekuWin-program for the first time, selection window of communication settings appears automatically. Choose in this window COM port and communication speed (BPS).
Use automatic Baud speed selection (Auto).
Set Preamble=0, Address and Slot=0. These functions are not used in 6740 transmitter.
Main window has green quick menu (Quick) with four buttons (if it is not visible, choose it in pull down menu Window/Quick).

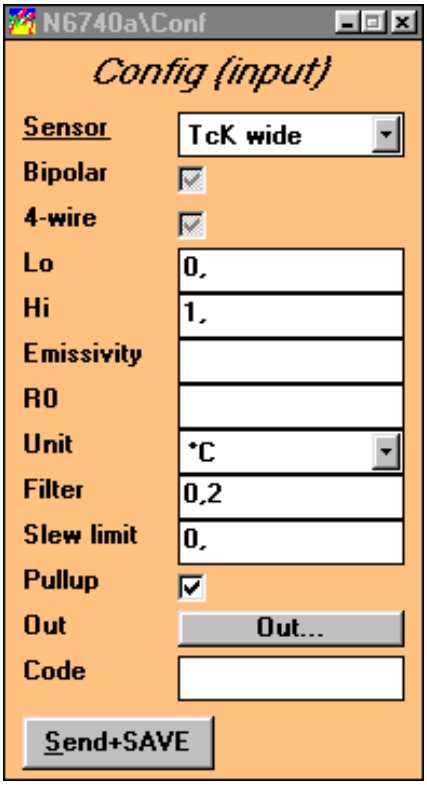
The highest button opens common computer settings window mentioned above. Second button (Conf) makes the contact with target device. If communication fails, check computer settings, connection of programming cable and power supply.

Sensor selections:

When connection with transmitter exists, display shows input settings menu. Select sensor type in Sensor. Menu texts may change according to selected sensor type.
After selections, settings are sent to transmitter by Send+Save button.

Input signal setting:

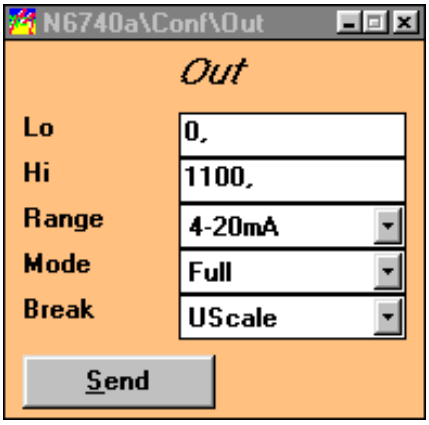
Sensor	sensor type
Bip	Bipolar measurement is possible by unscaled inputs (mV, V and mA). Measuring range covers also negative value, f.ex. ±100mA.
4-wire	4-wire measurement is possible by inputs ohm, Pt or Ni. You must select 4-wire measurement also measuring card (jumper).
Lo	Min. input value (process inputs). By unscaled inputs function **Lo** acts as zero shift and can be used to correct sensor error.
Hi	Max. input value (process inputs). By unscaled inputs **Hi** acts as input multiplier by which you can scale input value.
Emis	emission or input coefficient, 1=not in use
R0	0° C resistance value of RTD (set Pt100=100 ohm)
Unit	Celsius/Fahrenheit selection (to monitor display)
Filter	digital filter, 1…0.001, 1=not in use
Slew limit	limits the inputs slew rate. Defines how much the new measurement result can differ from previous one (measuring rate 4 times/second). This function can be disabled by setting it on a larger value than the measuring range or on the value 0 (default value 0).
Pullup	selection of sensor break down (ON/OFF)
Output	opening of output window
Code	Secret code for setting changes.Secret code protects the transmitter against unwanted changes. It is 6-digit numeral value. Default value is 000000 (code not in use). If you happen to loose the secret code, the manufacturer will give you reset instructions for new value.



Typical settings for K-type thermocouple

Selection of output signal range.
Open output window with Out-button

Lo	scaled input value corresponding output 4.00 mA
Hi	scaled input value corresponding output 20.00 mA
Range	Selection of output range
Mode	limits output to 4.00/20.00 mA or to 3.5/ 24.0 mA when input exceeds or remains below measuring range
Break	output up or down after sensor break
Send	send settings to transmitter



Settings:

In configuration menu select input filtering and scaling of output. Settings of input and output have separate windows (Input, Output). In addition, serial signal (Serial) has its own window which is needed only when modem card is installed in transmitter (model 6725).

After sensor selection you may set various correcting coefficients and filters.

When you install settings, notice whether your PC uses comma or period. Erronous decimal point is not accepted.

Thermocouple inputs TcB..TcT
Thermocouple types are marked shortly Tc + sensor, f.ex. TcB=B-type, TcK=K-type etc.. Type K has two ranges. Narrow range TcKn (-80…+450) has better linearization. Broader range TcK covers whole range (-150..+1370 C). If sensor signal is too small or too big, the value can be corrected by Emis-value. F.ex. you want to correct sensor value at its max. reading by +2 %. Set Emis-value 0.98. Default value is 1.

Correction of thermocouple sensor error
Thermocouples are linearized to temperature. Sometimes you need to correct sensor signal. By IR-thermopile sensor this need depends on the emissivity of target device.

Emis-coefficient has following effect:
Difference between measured temperature value and cold junction temperature is divided by **Emis**-value and the result is added to coldjunction temperature. Finally **Lo**-value is added. Emis is reverse value of slope and its corner point is cold junction temperature or environment temperature of transmitter.

Tcj = transmitter environment temperature (abt.)
Ts = Uncorrected sensor temperature measured by transmitter
Tn = corrected temperature to display; true temperature
6740 calculates Tn = (Ts-Tcj) / (Emis + Tcj + Lo).

The use of slope to correct sensor error (one point correction): Set Emis = 1, Lo = 0.
Heat sensor to calibration temperature. Measure true sensor temperature Tn and temperature Ts measured by 6740. Calculate: Emis = (Ts-Tcj) / (Tn-Tcj)

F.ex. true sensor temperature Tn = 27 °C. Temperature measured by transmitter Ts = 895 °C. Set Correction coefficient Emis = (895-27 °C) / (900-27) = 0.9942. At high temperatures cold junction temperature effect is very small in Emis calculation. You may measure cold junction temperature Tcj easily by connecting jumper to sensor input. 6740 shows its cold junction temperature at terminal block.
Temperature measurement with RTD´s
Temperature sensors Pt100, Pt250, Pt1000 and Ni100 are available. Sensor connection 3- or 4-wire.
4-wiring requires jumper setting on circuit board, see picture on page 7.
You can change sensor type by R0-value to Pt100…Pt1000 sensor only by giving resistance value in 0 °C, f.ex. for Pt100 sensor R0 = 100.0 ohm or for pt250 sensor R0 = 250.0 ohm etc..

Calibration and error correction of RTD's
6740 assumes that sensor resistance in 0 °C is exactly R0-setting. This means that 6740 compares sensor resistance always with R0-setting. If 6740 shows too high temperature measured by the individual sensor, the sensor resistance is higher than nominal and you must increase R0-value.
Advantage of this method is that also sensors can be calibrated by giving the real measured resistance in 0 °C. F.ex. if sensor resistance in 0 °C is 100.1 ohm, R0-value will be 100.1 ohm.

Eliminating sensor tolerance may be done, if necessary, also in other than 0 °C temperature. Because Platin resistance sensors are not fully linear, you have to calculate R0-value according to equation below (other than 0 °C temperature corrections) when high accuracy is requested.

R0 = valid R0-setting (f.ex. Pt100=100)

R0n = corrected R0-setting (equation below)
Ts = Uncorrected sensor temperature measured by transmitter
Tn = corrected temperature to display; true temperature
Kpt = Temp. coefficient of platin in RTD-table corresponding temp. in question (abt. 0.385 ohm/°C)

Calculate new R0:

R0n = R0 * (Ts * Kpt + 1) / (Tn * Kpt + 1)

F.ex. Sensor true temp. Tn = 100 °C and 6740 shows Ts = 99.7 °C, R0 = 100 (basic value).
Calculate correction Ron = 100 * (99.7 * 0.385 + 1 / (100 * 0.385 + 1) = 99.71

Potentiometers
Potentiometer resistance value is 50…500 ohm by 3-wire connection and 0…1000 ohm by 2-wire connection. When potentiometer glide moves from one end to the other of the potentiometer range , display value turns into Lo…Hi.
As you do not always use the whole potentiometer range, this must be noticed in scaling. The easiest way is to exploit output scaling as follows: set in input window f.ex. Lo=0 and Hi=100. Drive potentiometer from beginning to end and notice display values of 6740 (monitor). Set these values in output window as Lo- and Hi-values of mA-output.

When performing variable resistance measurement (0…1000 ohm), the scaling is done like in point Abs. sensor inputs.The sensor selection in menu = ohm.

0/4..20 mA and 0..5/10V process inputs
Input ranges: 0-5V, 0-10V, 0-20mA, 4-20mA. When process signal is selected, scale the input first directly as engineering units on monitor display. Set min. (Lo) and max. (Hi) corresponding value, f.ex. input 0-10V corresponds in display range 200-500. Set Lo=200 and Hi=500 (output range is set in its own window). In case of V-input, the jumper of the measuring card must be in position 1-2 (mV-inputs do not need jumper setting).

Abs. inputs V, ±10 V, 20 mA and ohm
The abs. inputs as not scale in the same way as process inputs simply by giving wanted display values to monitor-display. In abs. inputs Hi-setting acts as coefficient to which Lo-value is added. If input starts from zero set Lo = 0 V (Ma, ohm), input is multiplied in this case only by Hi-value. You may select bipolar input by making cross to square (Bip) in menu. If you do not need bipolar input, select always unipolar input because then max. resolution of A/D-conversion (1/64000) is available.

mV-inputs
mV inputs may be uni- or bipolar on range +-100 mV (Bip). Unipolar range is more accurate because max. resolution of A/D-conversion (1/64000) is available. Selection Bip=Bipolar.

Infrared-sensors
Non contacting IR-sensor ranges are linearized on whole measuring range for sensor types Exergen 140F-K (-40..+350°C) and E440 (-30..+600°C). Emission coefficient corrects measured value to show true temperature according to emissivity of target object. Exergen sensors are calibrated for emission coefficient 0.9 (grey body). If object emision coefficient is 0.7 set Emis-value 0.7/0.9 = 0.77.
More details in point Thermocouple and IR-sensor correcting coefficients (experimental Emis-control).

Other settings

Bip: Bipolar measurement is possible by unscaled inputs (mV, V and mA). Measuring range covers also negative value, f.ex. ±100mA.

4-wire: 4-wire measurement is possible by inputs ohm, Pt or Ni. You must select 4-wire measurement also measuring card (jumper).

Lo: Min. input value (process inputs, f.ex. 4 mA). By unscaled inputs function **Lo** acts as zero shift and can be used to correct sensor error. Value is given in engineering unit f.ex. -5 °C. Zero shift is added first eventually set Hi-coefficient.

Hi: Max. input value (process inputs, f.ex. 20 mA). By unscaled inputs **Hi** acts as input multiplier by which you can scale input value.

Emis: Emission or input multiplier, 1 = multiplier 1.

R0: RTD's 0 °C resistance value (f.ex. set Pt100 = 100 ohm)

Unit: C/F selection only with temperature sensors (Tc/Pt/Ni).

Filt: filter
Not in use =1.000. Normal filtering 0.200 means (1/0.2=5) that the latest measurement includes one new and four old measurements. Diminishing the filter value increases the damping effect. Filtering behaves like RC-circuit.

Slew: slew rate
One measurement can not change measuring result more than slew-value allows.
It can be used to eliminate interference peaks. One measurement lasts abt.0.25 second so if slew value is 1, the measuring result can raise 4 units in one second (f.ex. 4C/s). If you prefer not to to use this limiter, set value larger than measuring range or value 0.

Pullup: sensor break pullup
If pullup is set on, a weak current is fed from time to time to sensor line in order to find out eventual sensor breaks. Function does not work with process signals (V, mA). In

these signals internal pulldown leads input to 0 V or to 0 mA. Pullup is not recommended with high impedance sensors (f.ex. Exergen) because the feeding of intermittent current to sensor line disturbs measuring (capacitive charge). By RTD´s pullup is useful for wire breaks; sensor break is always detected.

Serial: You can set transmitter address when optional card for digital communication is installed.
Optional card changes transmitter to model 6725.
Default value 0.

Code: secret code for setting changes
Secret code protects the transmitter against unwanted changes. It is 6-digit numeral value. Default value is 000000 (not in use). If you happen to loose the secret code, the manufacturer will give you reset instructions for new setting.

Output settings:

Lo: Scaled input or sensor value corresponding to output 4.00 mA

Hi: scaled input or sensor value corresponding 20.00 mA. Value can be anything inside selected sensor measuring range.If input is scaled process signal output Lo and Hi value are set in engineering units f.ex. input 0-10V=0-1000, output wanted 0-900=4-20mA, set Lo=0 and Hi=900.

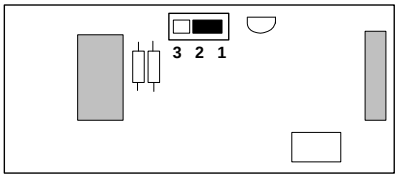
Range: Selection of output range(0..20mA, 4..20mA, 0..5V or 0..10V)
Mode: selection of output function range
- Limit: output limited to 4..20 mA, also after sensor break
- Full: functions abt. 3.5..24 mA and indicates therefore range exceeding and sensor break
- Lim-bk: limited to 4..20 mA, except when a sensor break is detected, the output is driven to 3,5 or 24 mA

Break: direction of output after sensor break
- DScale: in fault situation leads output to value <4mA
- UScale: in fault situation leads output to value >20 mA (or 20.00 mA if Mode=Limit)

4-wire connection of voltage input (10V) and of resistance measurement on measuring card

Unusual sensor inputs require jumper selection on measuring card. Open the right hand cover of the transmitter. You can easily remove measuring card from basic board. Select jumper position according to picture below.

Jumper selections of input card



Voltage input 0-10V:
Jumper selection 1-2
(Factory setting)

4-wire RTD-sensors:
Jumper selection 2-3

Hand held programmer 6790

You can easily program transmitters with hand held programmer which is particularly useful in field conditions. Menu structure is similar to PC-program. Programmer is simply connected to transmitters plug socket Prog with cable. Programmer is universal and does not include configuration program which is loaded from transmitter to be configured.

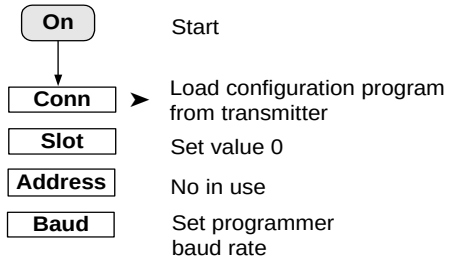
The use of programmer

When you have swicthed on 6790, display shows text Conn. Set first serial communication baud rate 9600 (Baud) and then Slot setting value 0 (default value). Address is not needed.

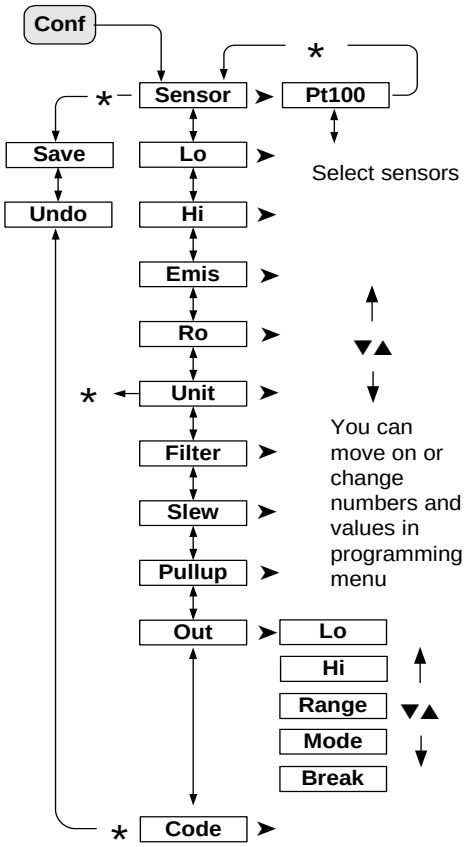
Switch on power supply 24 V and connect cable to transmitter plug socket Prog. Now you can start loading of configuration program from transmitter by pushing ä button. Loading takes a few seconds. If sensor is connected to transmitter, display shows sensor measuring value. An open input may show random values.

Start programming by pushing Conf-button until the menu shows text Sensor. If you like to change sensor push ä button and make changes by s t buttons. After selection come back to main level by i-button.

Settings are sent or canceled in Save or Undo stage by ä button.



Start programming by pushing Conf -button



Input settings:

Sensor	Selection of sensor type.
Bip	Bipolar measurement is possible by unscaled inputs Measuring range covers also negative value.
4-wire	ohm-, Pt ja Ni-sensor 4-wire connection
Lo	Zero shift (sensor calibration if necessary).
Hi	Scaling of input (only mA- and V-inputs).
Emis	Emission or input coefficient, **1 = not in use.**
R0	RTD's 0 °C resistance value (set Pt100=100 ohm).
Unit	Selection of Celsius/Fahrenheit (monitor näytölle).
Filter	Digital filter, 1...0.001, **1 = not in use.**
Slew limit	Limiter of slew rate. One measurement can not change measuring result more than slew-value allows (measuring rate is 4 times/second). If you do not want to use it, set value 0 or larger than measuring range.
Pullup	Selection of sensor break sensing (ON/OFF).
Code	Setting of secret code. You can not change settings without secret code if it is set to other than default value 000000.

Selection of output range:
Select wanted part of input sensor range or of scaled mA- or V-input (on display) F.ex. input 0..10V = display 0..2000, output range 0..1500 = 4..20 mA.

Out	Output setting menu.
Lo	Input value (on display) corresponding output 4.00mA
Hi	Input value (on display) corresponding output 20.00 mA
Range	Selection of output range (0..20mA, 4..20mA, 0..5V or 0..10V)
Mode	Limits output to value 4.00/20.00 mA, or to 3.5/24.0 mA when input goes over or below measuring range.
Break	State of output after sensor break (**ä**), up or down.
Save	**Exit programming stage by i button and save settings to transmitter by ä button.**
Undo	Cancel settings and exit without saving by **ä** button**.**

Settings are described in more details on pages 6 and 8.

Notes:

Notes:

Manufacturer:

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