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COMECO
CONTROL & MEASUREMENT

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PROGRAMMABLE CONTROLLER

RT28U

with keyboard

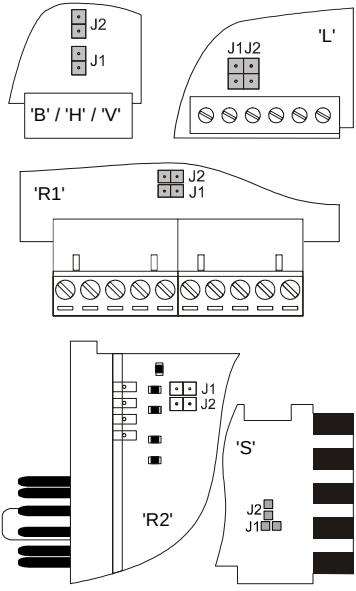
OPERATION MANUAL

Please read this Operation Manual before mounting and operating.
Save the Manual for future references.

Overview

RT28U is a low-cost multifunctional programmable controller. Its universal input accepts the most common RTDs, thermocouples, and linear signals. The device can be equipped with up to 2 relay outputs, which can control various actuators using ON/OFF control algorithm, and the optional RS485 interface enables networking. RT28U allows adjusting of the built-in digital filters and the programmable output delay, resulting in increased operation reliability in case of industrial interferences.

Input Setting



- Open the case.
- Follow the diagrams on the left to find the configuration jumpers J1 and J2, located on the main board (cases 'B', 'H', 'V', 'L', 'R1', and 'R2') or on the outer side of the right board (case 'S').
- To set input 0...10 V, short out J2.
- To set any of the other possible input types, short out J1.

Mounting

Panel mounting ('B' / 'H' / 'V' / 'S' / 'L')

- Place RT28U into an appropriate panel cut-out.
- Tighten it into place using the enclosed mounting bracket(s).

Rail mounting ('R1')

- Insert the upper rail edge into the upper plastic groove of the rail-installing mechanism on the back side of the unit.
- Press the unit towards the lower rail edge until the moving part of the installing mechanism clicks.

Rail mounting ('R2')

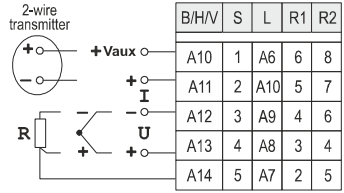
The device can be easily mounted on every 35 mm rail conforming to EN50022 by the means of a standard UNDECAL socket base.

Electro-Magnetic Interference (EMI) Issues

Important note:

A built-in RC noise suppression circuit may be connected in parallel with relay contacts. Full AC voltage isolation may NOT be provided when relay contacts are open. Small AC current (≈ 1.5 mA at 230 VAC) may still flow through the RC circuit.

- All signal wires must be shielded. They must not be packaged together with power cables.
- Never lay the signal wires close to inductive or capacitive noise sources, such as relays, contactors, motors, etc.
- All shields have to be grounded ONLY at one end, as closer as possible to the controller terminals.
- Avoid sharing supply lines with powerful consumers, especially with inductive loads, switched on and off.
- To stop unwelcome interference signals entering through the power supply lines, use shielded 1:1 isolation transformer.
- Shunt all switched (not only those switched by the controller) inductive consumers with special suppression networks: RC group and varistor - for AC loads, or diode - for DC loads.
- If the controller operates in a very powerful EMI area, it has to be mounted inside a grounded metal shielding box.
- To protect the interface from electro-magnetic disturbances, follow the RS485 standard guidelines.

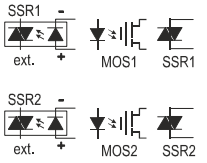


B/H/V	S	L	R1	R2
A10	1	A6	6	8
A11	2	A10	5	7
A12	3	A9	4	6
A13	4	A8	3	4
A14	5	A7	2	5

Input signal wiring

Connect the input with regard to its type through the respective and depending on the case type (see '**Specifications**') terminals on the device back.

Voltage transmitters should be powered ONLY by external source.



B/H/V	S	L	R1	R2
A4	8	A1	16	11
A5	7	A2	15	9
A6	6*	A3	14	
A7	9	A4	19	1
A8	10	A5	18	3
A9	12**		17	

* not available with 90...250 V power supply
** not available when serial interface is installed

Output wiring

Connect the outputs with regard to their types (see '**Specifications**') via the respective terminals.

	B	H/V/L	S	R1	R2
GND	C3	B3		11	
B	C1	B1	11	9	
A	C2	B2	12	10	

RS485 wiring

Connect the unit to the RS485 network line via the respective terminals or connector.

	B/H/V	S	L*	L**	R1	R2
L(+)	A1	13	B10	A11	21	2
	A2	6*	B11		23	
N(-)	A3	14	B12	A12	22	10

* 90...250 V ** 12...24 V

Power supply wiring

Connect the right power supply voltage for your device (see '**Specifications**') through the respective terminals.

Important notes:

- *Power supply must be turned off during mounting and wiring.*
- *In case of 90...250 V power supply, grounding the device via separate wire is mandatory for covering safety standards.*
- *Strictly observe the requirements for RS485 network building.*

More detailed wiring schematics are available at comecogroup.com under 'Support' tab.

Some parameters are accessible only when the respective functionality is installed. (see '**Specifications**'*).*

- *Changing* **Point Position** *value reflects on the real value of all parameters with ISU.*

E.g.: changing **Point Position** *value from (0) to (0.0) would change a set-point value of 100 to 10.0.*

Device parameters

RT28U is a programmable device whose service behavior is determined by a set of parameters. All the parameters, along with their names, symbols, and value ranges, are given in Table 1.

Setting numerical parameter value

- Enter parameter value adjustment mode (see '**Program Levels**').
- The whole part of the value together with the left zeroes appears on the display, and the rightmost digit blinks.
- To select another digit, press [◆].
- The 2 rightmost digits can accept values from 0 to 9, and the leftmost digit can also accept the values - and 1.
- To increase or decrease the blinking digit value, use respectively [≪] or [≫].
- Confirm the adjusted value by pressing simultaneously [◆] + [≪] or [◆] + [≫].
- If the new value has not been confirmed and no key has been pressed for a certain period of time, value adjustment automatically ceases, and the parameter retains its initial value.

Setting symbolic parameter value

- Enter parameter value adjustment mode (see '**Program Levels**').
- Read the blinking parameter value.
- To change the value, use [≪] or [≫], and to confirm, press [◆] + [≪] or [◆] + [≫].
- If the new value has not been confirmed and no key has been pressed for a certain period of time, value adjustment automatically ceases, and the parameter retains its initial value.

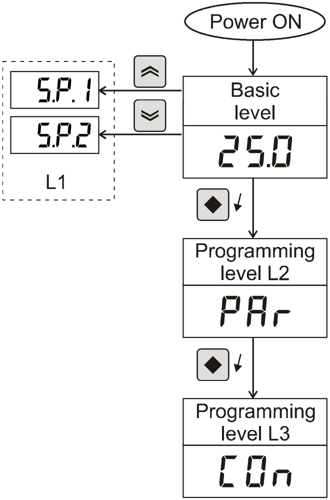
Parameter	Symbol	Description
Parameters of Level L3		
Input Type	inP	Type of signal that can be connected to the device input
Unit	Uni	Temperature measurement unit
Point Position	Pnt	Display decimal point position
Input Low	i.Lo	Display value at low limit of the linear input range
Input High	i.Hi	Display value at high limit of the linear input range
Input Correction	i.Cr	Constant to be added to the measured input value
Address	Adr	Device address
Baud Rate	bAu	Serial interface rate
Gradient	Grd	Maximum admissible input change for 120 ms sampling period
Filter Time	Ft	Relative time constant of the input filter
Filter Band	Fb	Zone around the measured value, within which the filter is active
SP Limit Low	SPL	Set-point low limit
SP Limit High	SPH	Set-point high limit
Direction 1	dr.1	Control action direction of output **K1**
Direction 2	dr.2	Control action direction of output **K2**
Parameters of Level L2		
+Differential 1	P.d.1	Relay switching differential over set point for output **K1**
-Differential 1	n.d.1	Relay switching differential under set point for output **K1**
Time On 1	t.n.1	ON duration of pulsed output **K1**
Time Off 1	t.F.1	OFF duration of pulsed output **K1**
Hold 1	HL.1	Holds the output **K1** reaction
The same 5 parameters, but with index 2 - for output **K2**		
Parameters of Level L1		
Set Point 1	SP.1	Set-point value of output **K1**
Set Point 2	SP.2	Set-point value of output **K2**

Table 1

Value	Unit	Notes
PtH, PtE	-	Pt100: -100…850 °C, Pt1000: -100…600 °C
Pc.1, Pc.2	-	PTC 1k: -50...150 °C, PTC 2k: -50...150 °C
r.0.1	-	resistive linear: 0…1 kΩ
t.c.b	-	T/C "B": 200...999 °C
t.c.J	-	T/C "J": -20...999 °C
t.c.K	-	T/C "K": -20...999 °C
t.c.r	-	T/C "R": 0...999 °C
t.c.S	-	T/C "S": 0...999 °C
t.c.t	-	T/C "T": -40...400 °C
u	-	voltage linear: 0…100 mV
,.0.,.4	-	current linear: 0…20 mA, 4…20 mA
u.10	-	voltage linear: 0…10 V
°C, °F	-	°C, °F
0, 0.0, 0.00	-	when indicating values with the input-signal measurement unit (**ISU**)
-199 ... 999	ISU	These parameters make sense ONLY in case of a linear input signal.
-199 ... 999	ISU	display offset value
1…254	-	
1.2, 2.4, 4.8, 9.6	bps	1200, 2400, 4800 (factory-set), 9600 bps
0 … 999	ISU	used for input peak filtration; value '0' cancels the filtration
0 … 999	-	This parameter and the following one define a low-pass input filter.
0 … **M**	ISU	temperature: whole part of **M** ≤ 100; linear: **M** = 25% of input range
within input range	ISU	These parameters keep the set points in safe limits, preserving them from random changes.
coo, hEA	-	'**coo**ling' - activates over set point, '**hea**ting' - activates under set point

0 ... 999	ISU	less than (high range limit - **Set Point 1**)
0 ... 999	ISU	less than (**Set Point 1** - low range limit)
0 ... 999	sec.	pulse duration; value '0' disables pulse mode
0 ... 999	sec.	pause duration; value '0' disables pulse mode
0 ... 999	sec.	Value '0' disables hold mode.

-199 ... 999	ISU	within range **SP Limit Low** ... **SP Limit High**



Basic level

At power-on, RT28U enters Basic level. At this level, the device indicates the measured input value (PV) with a resolution, according to the **Point Position** parameter.

- If the whole part of PV cannot be entirely displayed, the unit generates a blinking 'overflow' message (oL or -oL, depending on PV sign).
- If PV is out of its operating range (the input range according to Table 1, extended by 5% on both sides), the device displays blinking symbolic message: (under-range) or (over-range). When PV is out of physical range, the unit displays - - - .
- Upon entering Basic level, RT28U may display the ini message, indicating that some time is necessary for filter initialization.
- The noi message may appear as a result of the peak filter operation (see '**Input filtration**').

Set-point adjustment (Level L1)

- To enter **Set Point 1** adjustment mode, press and hold [▲] until S.P.1 appears on the display. Release the key to view the set-point value.
- To enter **Set Point 2** adjustment mode, follow the same procedure, but start with the [▼] key.

Program Levels

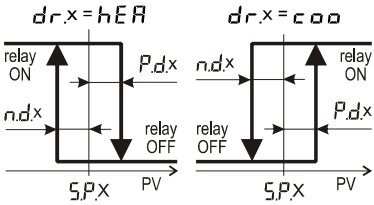
Programming (Levels L2 and L3)

- Enter from Basic level by pressing and holding [◆].
- To access and adjust the parameters from level L2, release the key while PAr is displayed. To enter level L3, release the key when Con appears on the display.
- Choose a parameter using [⩓] or [⩔].
- To enter parameter value adjustment mode, press [◆].
- If no key has been pressed for a while, the device automatically returns to Basic level, storing all confirmed changes.
- For quick exiting and saving, use key combination [⩓] + [⩔].

Output Control

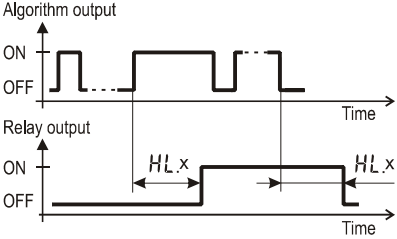
Control output operation

- The control outputs operate according to the control algorithm parameters.
- The outputs deactivate with the value change of one of the following configuration parameters - **Point Position**, **Input Low**, **Input High**, and **Input Correction** - and remain inactive till Basic level is entered.
- The outputs deactivate also when an error has been detected (see '**Error messaging**') and remain inactive until all discrepancies are resolved and programming exited.
- An input failure deactivates the outputs too.



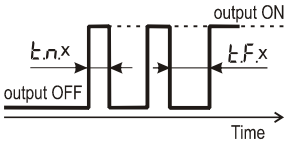
ON/OFF control algorithm

The static characteristic of a relay controlled by an ON/OFF algorithm is shown on the left drawing.



Output hold

For eliminating undesirable output switches, additional parameter (**Hold**) is assigned to hold the output reaction for certain period of time.



Output pulse mode

When an output is activated by the control algorithm, it can either stay ON or pulse depending on **Time On** and **Time Off** parameter values.

Peak filter

This filter is intended for eliminating pulse spikes (peaks), which can appear in the input signal, in the following way:

- RT28U measures the input signal value every 120 ms (sample time).
- The measured values are compared subsequently. The filter checks the difference between the last 2 samples. If it does not exceed **Gradient** value, the device accepts the signal as *normal*.
- If the last measured value differs from the previous one by more than the **Gradient** value, the filter output is held until the device determines a presence of a *normal* signal. It is possible only if the input signal has not been changed with more than the **Gradient** value for 4 subsequent samples.
- If the device has not determined a *normal* signal for 20 subsequent samples, nOi appears on the display (see 'Basic level').

Low-pass filter

This first-order filter acts ONLY within a certain band around filter output value. This has been designed to cut periodic noises outside the communication signal spectrum.

- Filter operation is defined by two parameters:
  Filter Time (defines filter time constant) and **Filter Band** (defines filter active band around filter output value).
- If the newly measured value differs from the filter output by more than **Filter Band**, the filter resets with a new initial output value (newly measured value).

Message	Parameters	Error type
FAL	all	incorrect memory
brt	-	service required
E.01	Grd	out of range
E.02	F.t	out of range
E.03	F.b	out of range
E.04	SP.L	out of range
E.05	SP.H	out of range
E.06	SP.L , SP.H	SP.L > SP.H
E.11, E.21	t.n.1, t.n.2	out of range
E.12, E.22	t.F.1, t.F.2	out of range
E.13, E.23	HL.1, HL2	out of range
E.14, E.24	P.d.1, P.d.2	out of range
E.15, E.25	n.d.1, n.d.2	out of range
E.16, E.26	SP.1, SP.2	outside SP.L ...SP.H
E.17, E.27	SP.x - n.d.x	under input range
E.18, E.28	SP.x + P.d.x	over input range
E.29	Adr	out of range

- In some cases, RT28U finds discrepancies in parameter values that must be resolved before operating at Basic level.
- The device indicates such kind of problems by displaying error messages as given on the left.
- If FAL appears on the display, try debugging by turning the power off/on.
- If the problem persists, press and hold ◆ or send command `error 0` via the communication interface to restore the default (factory) settings.

Table 2

Parameter	Symbol	Value
Input Type	inp	pt100, pt1000, ptc1, ptc2, r.0.1k, t.c.b, t.c.j, t.c.k, t.c.r, t.c.s, t.c.t, u, u.0.10, i.0.20, i.4.20
Unit	unit	c, f
Point Position	pnt	0, 1, 2
Input Low	i.hi	-199...999
Input High	i.lo	-199...999
Input Correction	i.cor	-199...999
Address	addr	1...254
Baud Rate	baud	1200, 2400, 4800, 9600
Gradient	grad	0...999
Filter Time	f.t	0...999
Filter Band	f.b	0...M
Input Value	p.v	*
Error Info	error	**

* **Input Value** (read-only)

numerical value with ISU - measured input value
sat.lo - ADC under-range
sat.hi - ADC over-range
inp.br - sensor break
break - device failure
noise - noisy measurement

** **Error Info**

0 - initializes non-volatile memory
-1 - error FAIL (read-only)
1...29 - errors E.01... E.29 (read-only)

Protocol architecture

- The protocol is based on UART protocol with:
  - Baud Rate - as defined by parameter **Baud Rate**;
  - Data bits - 8;
  - Parity Control - Even;
  - Stop bit - 1.
- ASCII protocol is used for communicating, and the information is exchanged in frames.
- Each frame consists of 1, or 2 words separated by byte 32 (SPACE), and ends with bytes 13 (CR) and 10 (LF). The first word in the frame denotes the parameter 'Symbol' as taken from Table 2 and the second word (if needed) is the parameter 'Value', both spelled with only small Latin letters, digits, dots, and/or the '-' sign.

Device activating

- To respond to commands, the device should be active.
- For a device to be activated, it must receive a Ux command, where 'x' is the value of the parameter **Address** or the value '255' (if device address is unknown), and respond to it with ok..
- If a device does not respond even to U255, check the UART protocol settings, chiefly **Baud Rate** value.

Notes:

- *RT28U adds 3 spaces in the beginning of the response.*
- *RT28U returns decimal point even when the value is integer.*
- *#13 (CR) is byte 0x0D; #10 (LF) is byte 0x0A.*
- *The* U255 *command should be used only in case just 1 slave is presented.*

Protocol examples:

PC or other device: RT28U response:

activating device number 10

```
U10#13#10          ok.#13#10
```

reading filter time

```
f.t#13#10          f.t  0015.#13#10
```

writing filter time of 30

```
f.t 30#13#10       f.t  0030.#13#10
```

reading input value of 27.5

```
p.v#13#10          p.v  027.5#13#10
```

`invalid command.`	command not recognized
`parity error.`	parity error detected
`not a number.`	attempt to write symbols for numerical parameter
`point error.`	value resolution greater than parameter's one
`out of range.`	value out of range
`unit is busy.`	writing is allowed only to device at Basic level
`read only.`	parameter is read-only
`can't save.`	problem with writing in non-volatile memory

- The device remains active until it receives another Ux command, but with different device address, a FRL error, or with reset.
- Any **Baud Rate** value change through the communication interface also deactivates the device.

Reading from a device

- If the frame consists of only 1 word, it is recognized as a command for reading.
- The device responds to it by returning the same word and its value, according to Table 2.

Writing in a device

- If the frame consists of 2 words, it is recognized as a command for writing.
- With writing, transferred are the same 2 words that would have been received at the respective command for reading from the device.
- After successful writing, the device responds with the respective command for reading, except for the `baud` command.

Other device responses

- When **Error Info** value is `-1`, the device substitutes any command for `error` reading.
- RT28U responses in case of incorrect protocol use are given on the left.

Reset

To reset the device, send command `reset`.

Declaration of Conformity

CE

The undersigned hereby declares, on behalf of COMECO Inc., that this programmable controller model RT28U has been manufactured in compliance with standards EN 61010-1 and EN 61326-1, and meets the requirements of Directives 2004/108/EC, 2006/95/EC, and 2011/65/EU.

Krasimir Darakchiev, CEO
COMECO Inc.

Waste Disposal

Do not dispose of electronic devices together with household waste material.

If disposed of within European Union, this product should be treated and recycled in accordance with the laws of your jurisdiction implementing Directive 2012/19/EU on waste electrical and electronic equipment (WEEE).

Specifications

Case	☐ 'B', ☐ 'H', ☐ 'V', ☐ 'S', ☐ 'L', ☐ 'R1', ☐ 'R2'
Input	programmable
Outputs:	up to 2
Electromechanical relay	5A/250VAC with NO/NC or NO contact
SSR	☐ 1A/250VAC, ☐ 0.2A/250VAC
MOS gate	0.1A/60V, optically isolated
Output for external SSR	5...24 VDC, 30 mA
- K1	☐ relay, ☐ SSR, ☐ MOS gate, ☐ for ext. SSR
- K2	☐ relay, ☐ SSR, ☐ MOS gate, ☐ for ext. SSR
Serial Interface	☐ RS485, isolated, ☐ RS485 for "PolyMonitor", isolated
Power Supply	☐ 230 VAC, ☐ 90…250 V, ☐ 24 VDC, ☐ 12...24 V, ☐ .....
Excitation Voltage (Vaux)	☐ 10...30 V, 30 mA, ☐ 24 VDC, 30 mA, ☐ .....
Consumption	less than 3 VA
Measurement Error	≤ ± 0.3% from span
Temperature Drift	≤ ± 0.02% from span for 1 °C
RTD Line Error	≤ ± 0.001%/Ω at $R_{lin.}$ ≤ 50 Ω
Cold-junction Error	≤ ± 1 °C at air temperature -10…80 °C
Ambient Temperature / Humidity	-10…65 °C / 0…85% RH, non-condensing
Protection Class: front / terminals	☐ IP65, ☐ IP54, ☐ IP44 / IP20

Warranty and Support

……
serial number

……
manufacturing date

QC check mark ……(passed)
(stamp)

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QD-8.2.4-WC

Warranty

COMECO warrants this product to be free from defects in materials and workmanship for 2 years. If your unit is found to be defective within that time, we will promptly repair or replace it. This warranty does not cover accidental damage, wear or tear, or consequential or incidental loss. This warranty does not cover any defects caused by wrong transportation, storage, installation, or operating (see '**Specifications**').

Technical support

In the unlikely event that you encounter a problem with your COMECO device, please call your local dealer or contact directly our support team.