⚠️ Read this document carefully before using this device. The guarantee will be expired by device damages if you don't attend to the directions in the user manual. Also we don't accept any compensations for personal injury, material damage or capital disadvantages.

# ENDA EPC9513 Series Programmable Profile Controller

Thank you for choosing **EPC9513** series programmable profile controller.

* 96x96mm sized.
* 3,5 inches TFT , graphic and 5 digit display.
* Selectable  TC, RTD, NTC, R, mA, V or mV inputs.
* Input offset feature.
* 32 point linearization for analog inputs.
* Selectable relay, SSR,motorized valve or analog outputs.
* Selectable , input proportional transmitter output(mA or V).
* 50ms sampling time.
* PID control.
* PID selftune.
* PID auto-tune.
⚠️ **Selftune automatic PID calculation or manually enter PID parameters if known.**
* Soft-Start feature.
* 24Vdc for sensor supply.
* 16 program and 8 step for profile control.
* Selectable Single Setpoint Mode or Profile Control Mode.
* Digital inputs for profile control.
* In case of sensor failure manually , periodical or auto-periodical control can be selected.
* Security levels for menu and configuration pages.
* RS485 ModBus protocol communication feature.(optional)
* CE marked according to Europen Norms.
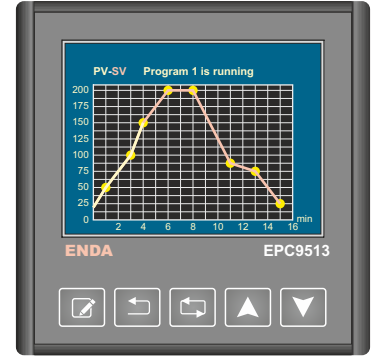
CE   R⊗HS Compliant

## Analog Inputs

| Input Type | | Range | | Accuracy | Input Resist. | Cable Color | | Standart |
|---|---|---|---|---|---|---|---|---|
| TC | B (Pt30Rh-Pt6Rh) | 200,0 ... 1800,0°C | 392,0 ... 3272,0°F | % ±0.1 and ±2°C (3,6°F) | Ri > 100kΩ | + undefined | - white | EN 60584 |
| | E (NiCr-Con) | -100,0 ..... 900,0°C | -148,0 ... 1652,0°F | % ±0.1 and ±0,5°C (1°F) | | + purple | - white | |
| | J (Fe-Con) | -100,0 ..... 900,0°C | -148,0 ... 1652,0°F | % ±0.1 and ±0,5°C (1°F) | | + black | - white | |
| | K (NiCr-Ni) | -100,0 ... 1300,0°C | -148,0 ... 2372,0°F | % ±0.1 and ±0,5°C (1°F) | | + green | - white | |
| | L (Fe-Con) | -100,0 ..... 900,0°C | -148,0 ... 1652,0°F | % ±0.1 and ±1.5°C (2.7°F) | | + red | - blue | DIN43710 |
| | N (NiCrSi-NiSi) | -200,0 ... 1300,0°C | -328,0 ... 2372,0°F | % ±0.1 and ±0,5°C (1°F) | | + lilac | - white | |
| | R (Pt13Rh-Pt) | 0,0 ... 1700,0°C | 32,0 ... 3092,0°F | % ±0.1 and ±1°C (1.8°F) | | + orange | - white | EN 60584 |
| | S (Pt10Rh-Pt) | 0,0 ... 1700,0°C | 32,0 ... 3092,0°F | % ±0.1 and ±1°C (1.8°F) | | + orange | - white | |
| | T (Cu-Con) | -250,0 ..... 300,0°C | -418,0 ..... 572,0°F | % ±0.1 and ±0,5°C (1°F) | | + brown | - white | |
| | U (Cu-Con) | -200,0 ..... 400,0°C | -328,0 ..... 752,0°F | % ±0.1 and ±0,5°C (1°F) | | + red | - brown | DIN43710 |
| RTD | Pt100 | -200,0 ..... 850,0°C | -328,0 ... 1562,0°F | % ±0.1 and ±0,5°C (1°F) | Ri > 100kΩ | Sensor current 250μA | | EN 60751 |
| | | -100,00 ... 160,00°C | -148,00 .. 320,00°F | | | | | |
| NTC | NTC | -60,0 ..... 150,0°C | -76,0 ..... 302,0°F | % ±0.1 and ±0,5°C (1°F) | Ri > 100kΩ | | | |
| mA | 0 - 20mA | -32768 ... 32767 | | % ±0.1 and ±1 digit | Ri = 50Ω | | | |
| | 4 - 20mA | -3276,8 ... 3276,7 | | | | | | |
| mV | 0 - 150mV | -327,68 ... 327,67 | | % ±0.1 and ±20μV | Ri > 100kΩ | | | |
| V | 0 - 5V | -32,768 ... 32,767 | | % ±0.1 and ±1 digit | Ri > 100kΩ | | | |
| | 1 - 5V | | | | | | | |
| | 0 - 10V | | | | | | | |
| Ω | 0 - 550Ω | | | % ±0.2 and ±0.1Ω | Ri > 100kΩ | Sensor current 250μA | | |
| | 0 - 10kΩ | | | % ±0.5 and ±10Ω | | | | |

## DIGITAL INPUTS (In order to use for profile control process)

| | |
|---|---|
| **Start-Stop Input** **Pause-Resume Input** **Previous Program Input** **Next Program Input** | 5V or 30V pulse , Ri=100kΩ |

## OUTPUTS

| | |
|---|---|
| Control/A.3/Valve On | 250V AC, 2A . Selectable as NO+NC.10.000.000 switch without load and 200.000 switch under 250V AC 2A (resistive load) |
| Alarm 1 | 250V AC, 2A . Selectable as NO+NC.10.000.000 switch without load and 200.000 switch under 250V AC 2A (resistive load) |
| Alarm 2/Valve Off | 250V AC, 2A . Selectable as NO.10.000.000 switch without load and 200.000 switch under 250V AC 2A (resistive load) |
| SSR | Max. 40mA , 0 - 12Volt , short-circuit protection. |
| mA | 0 - 20mA or 4 - 20mA  DC, % ±0,5 (Max. load resistance is 750Ω.) |
| V | 0 - 10V DC, % ±0,5 Max. 30mA (short-circuit protection.) |

## ELECTRICAL CHARACTERISTICS

| | |
|---|---|
| Supply | 90-250V AC, 50/60Hz |
| Power consumption | Max. 7VA |
| Wiring | 2.5mm² screw-terminal |
| EMC | EN 61326-1: 2013 |
| Safety requirements | EN 61010-1: 2010 (Pollution degree 2 , overvoltage category ||) |

## ENVIRONMENTAL CONDITIONS

| | |
|---|---|
| Ambient/storage temp. | 0 ... +50°C/-25 ... 70°C |
| Max. Relative humidity | Relative humidity 80% for temperatures up to 31°C , decreasing linearly to 50% relative humidity at 40°C. |
| Rated pollution degree | According to EN 60529     Front panel : IP65   ,     Rear panel   : IP20 |
| Height | Max. 2000m |

⚠️ **Do not use the device in locations subject to corrosive and flammable gases.**

## HOUSING

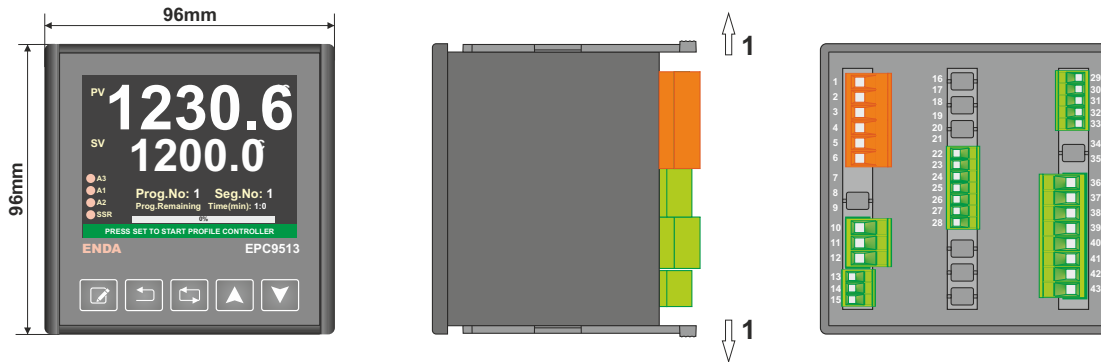| | |
|---|---|
| Housing type | Suitable for flush-panel mounting. |
| Dimensions | G96xY96xD81mm |
| Weight | Approx. 400g. |
| Enclosure material | Self extinguishing plastics. |

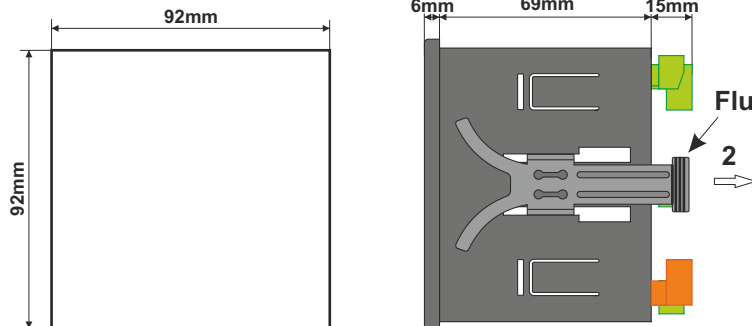⚠️ **While cleaning the device , solvents(thinner,gasoline,acid etc.) or corrosive materials must not be used.**

ENDA™

# DIMENSIONS



```
96mm
96mm
```

```
PV  1230.6
SV  1200.0
A3
A1    Prog.No: 1   Seg.No: 1
A2    Prog.Remaining   Time(min): 1:0
SSR              0%
PRESS SET TO START PROFILE CONTROLLER
ENDA                    EPC9513
```

## PANEL CUT-OUT



```
92mm
92mm
```

```
6mm   69mm   15mm
```

### Flush mounting clamp

**2**

For removing the device from panel :
- While pressing both flush mounting clamps of the device in direction **1 ,** pull it in direction **2.**

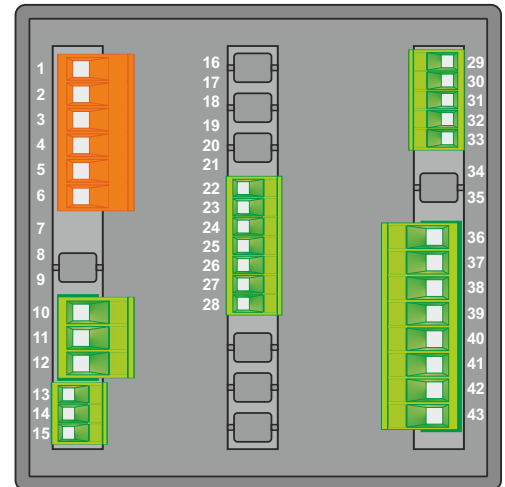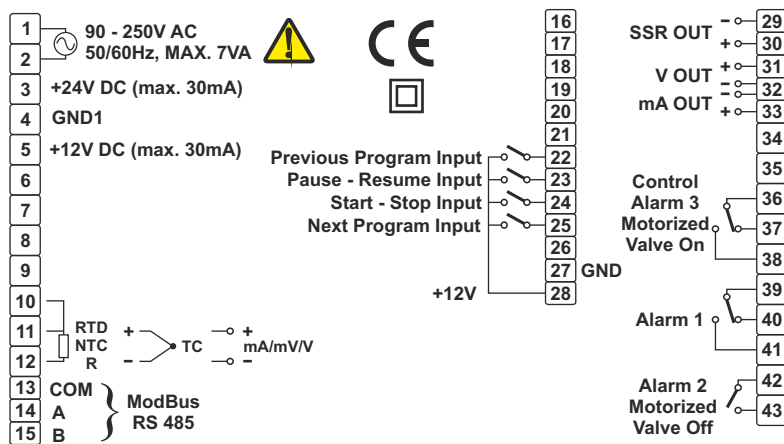Not :
1) Panel thickness should be maximum 7mm.
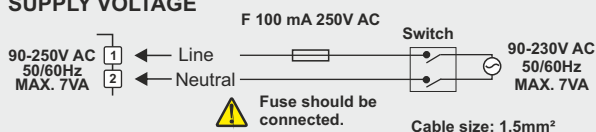2) If there is no 60mm free space at the back side of the device , it would be difficult to remove it from panel.

# CONNECTION DIAGRAM



**ENDA EPC9513** is intended for installation in control panels. Make sure that the device is used only for intended purpose. The electrical connections must carried out by a qualified staff and must be according to the relevant locally applicable regulations. During an installation , all of the cables that are connected to the device must be free of electrical power. The device must be protected against inadmissible humidity , vibrations , severe soiling and make sure that the operation temperature is not exceeded. The cables should not be close to the power cables or components.



| | |
|---|---|
| 1 | 90 - 250V AC |
| 2 | 50/60Hz, MAX. 7VA |
| 3 | +24V DC (max. 30mA) |
| 4 | GND1 |
| 5 | +12V DC (max. 30mA) |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | RTD  + |
| 12 | NTC  R  −  TC  mA/mV/V |
| 13 | COM |
| 14 | A  ModBus |
| 15 | B  RS 485 |

Previous Program Input — 22
Pause - Resume Input — 23
Start - Stop Input — 24
Next Program Input — 25

16
17    SSR OUT  − 29
18             + 30
19    V OUT    + 31
20             − 32
21    mA OUT   + 33

26
27 GND
28 +12V

SSR OUT — 29/30
V OUT — 31/32
mA OUT — 33

34
35
Control
Alarm 3   36
Motorized 37
Valve On  38

39
Alarm 1   40
41

Alarm 2   42
Motorized 43
Valve Off

## SUPPLY VOLTAGE

**F 100 mA 250V AC**

**Switch**

90-250V AC  1  ← Line
50/60Hz
MAX. 7VA    2  ← Neutral

**Fuse should be connected.**

90-230V AC
50/60Hz
MAX. 7VA

**Cable size: 1,5mm²**

Logic output of the instrument is not electrically insulated from the internal circuits. Therefore , when using grounding thermocouple , do not connect the logic output terminals to the ground.

Not : 1) Main supply cords shall meet the requirements of IEC 60227 or IEC60245.
2) In accordance with safety regulations,the power supply switch shall bring the identification of the relevant instrument and it should be easily accessible by the operator.
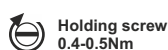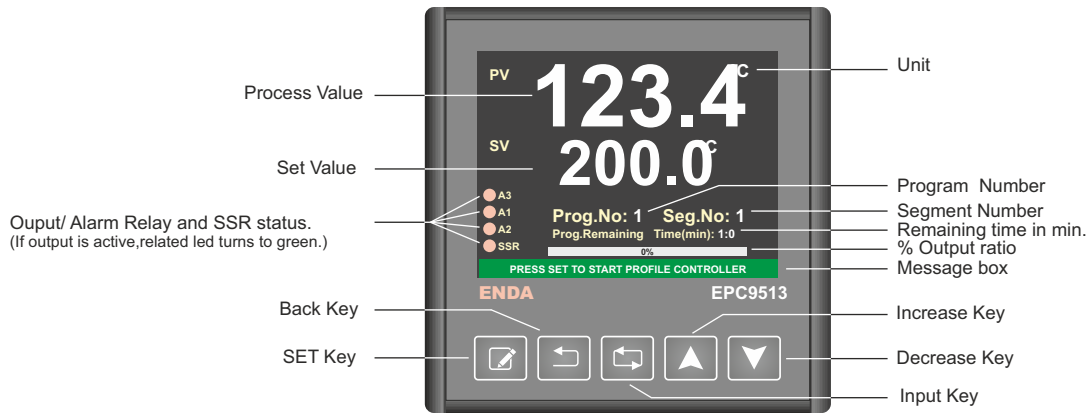
**Holding screw 0.4-0.5Nm**

**Equipment is protected throughout by DOUBLE INSULATION.**

## HOME SCREEN



Process Value — PV **123.4** °C — Unit

Set Value — SV **200.0** °C

Ouput/ Alarm Relay and SSR status.
(If output is active,related led turns to green.)
— A3, A1, A2, SSR

Prog.No: 1  Seg.No: 1 — Program Number / Segment Number
Prog.Remaining  Time(min): 1:0 — Remaining time in min.
0% — % Output ratio
PRESS SET TO START PROFILE CONTROLLER — Message box

ENDA  EPC9513

Back Key
SET Key
Increase Key
Decrease Key
Input Key

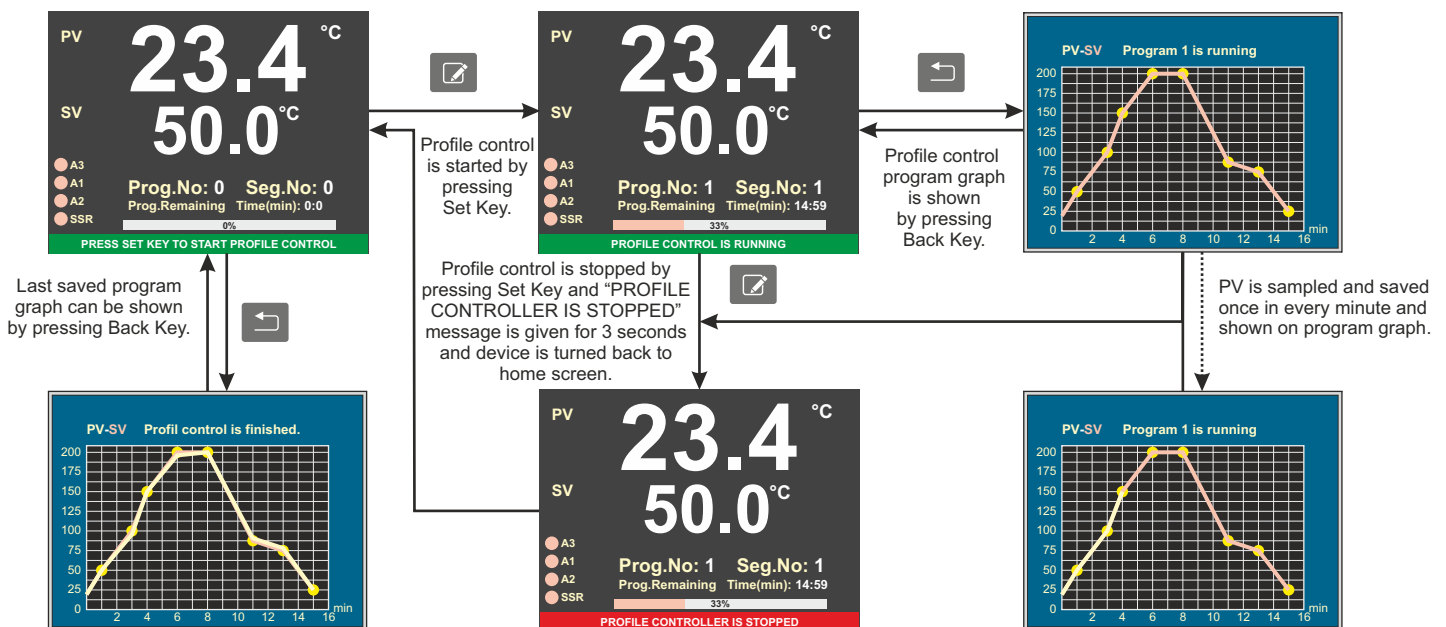| Key | Description |
|---|---|
| **SET Key** : | Start/Stop profile controller in "Profile Controller Mode", Select/Unselect parameter for increase/decrease parameter value in "Programming Mode". Change SV in "Single Setpoint Mode". |
| **Back Key** : | Return previous page in "Programming Mode". |
| **Enter Key** : | Enter main menu and open sub pages and transition between sub pages in "Programming Mode". Pause/Resume profile controller in "Profile Controller Mode". |
| **Increase Key** : | Transition between parameters (when parameter background is red) and increase selected parameter value (when parameter background is green) in "Programming Mode". |
| **Decrease Key** : | Transition between parameters (when parameter background is red) and decrease selected parameter value (when parameter background is green) in "Programming Mode". |

**NOTE 1 :** Device must be in "Profile Control Mode" in order to start/stop profile control by pressing Set Key.
**NOTE 2 :** When device in "Single Setpoint Mode", **Prog.No , Seg.No ve Prog.Remaning Time(min)** informations are not shown on home screen.
**NOTE 3 :** If Increase Key is held down while the device is powered up , factory parameters will be restored.
**NOTE 4 :** **"**Single Setpoint Mode" can be selected under "Profile Controller Configuration Page" sub menu , device make a control related to SV , which can be adjusted on home screen in "Single Setpoint Mode".

## Adjusting Device Set Value in Single Setpoint Mode
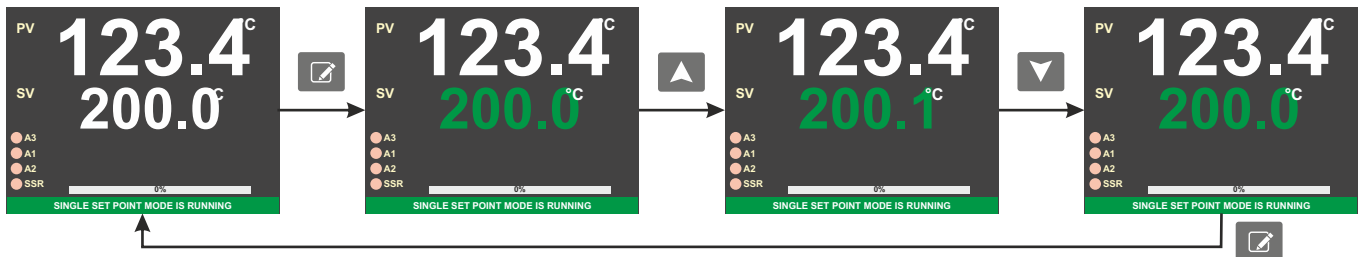


If Set Key pressed once , SV's color will be green. In this case SV is adjusted by pressing Increase/Decrease keys.
If Set Key pressed again or by waiting 3 seconds , SV's color will be white on home screen.

## Profile Control Mode



Last saved program graph can be shown by pressing Back Key.

Profile control is started by pressing Set Key.

Profile control is stopped by pressing Set Key and "PROFILE CONTROLLER IS STOPPED" message is given for 3 seconds and device is turned back to home screen.

Profile control program graph is shown by pressing Back Key.

PV is sampled and saved once in every minute and shown on program graph.

# Programming

Home Screen



Main menu is opened and "Programming Mode" is started by pressing Enter Key for 2 seconds.

**EPC9513 PROFILE CONTROLLER**
- Input Configuration Page
- Output Configuration Page
- Alarm Configuration Page
- PID Control Configuration Page
- Communication Configuration Page
- Security Configuration Page
- Calibration Page
- Profile Controller Configuration Page

Desired sub menu is selected by pressing Increase/Decrease Keys.

Selected sub menu is opened by pressing Enter Key.
Selected sub menu can be opened if permission is given from "Security Configuration Page".

If Back Key is pressed or by waiting 10 seconds , parameters will be saved and device turns back to home screen.

**NOT 5 :** *If power failure is occurs while device is programming , parameters won't be saved.*

## Programming Inputs (Input Configuration Page)

Desired parameter is selected by pressing Increase/Decrease Keys. Background of selected parameter turns red.

If SET Key is pressed , background of selected parameter turns to green and selected parameter can be adjusted to desired value.
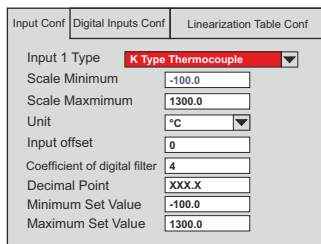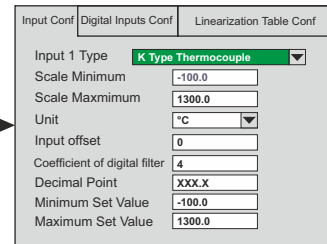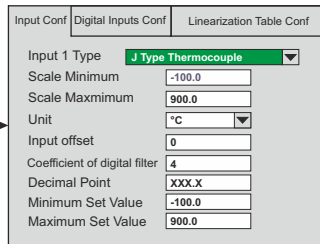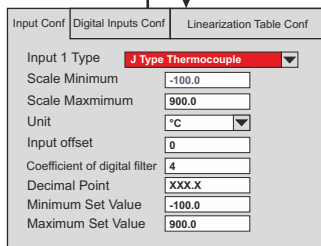
If SET Key is pressed again , background of selected parameter turns to red and exits from parameter adjustment.

If Back Key pressed or by waiting 10 seconds , Input Configuration Page is closed and device turns back to main menu.

**Input Conf | Digital Inputs Conf | Linearization Table Conf**

| Input 1 Type | J Type Thermocouple |
| Scale Minimum | -100.0 |
| Scale Maxmimum | 900.0 |
| Unit | °C |
| Input offset | 0 |
| Coefficient of digital filter | 4 |
| Decimal Point | XXX.X |
| Minimum Set Value | -100.0 |
| Maximum Set Value | 900.0 |

| Input 1 Type | K Type Thermocouple |
| Scale Minimum | -100.0 |
| Scale Maxmimum | 1300.0 |
| Unit | °C |
| Input offset | 0 |
| Coefficient of digital filter | 4 |
| Decimal Point | XXX.X |
| Minimum Set Value | -100.0 |
| Maximum Set Value | 1300.0 |

**Input 1 Type :**
B, E, J, K, L, N, R, S, T, U, Pt100, NTC, 0-20mA, 4-20mA, 0-5V, 1-5V, 0-10V, 0-150mV, 0-550Ω, 0-10kΩ

**Scale(Scale Min./Max.) :**
Adjustable between -32768 ... 32767
(Just for mA, V, mV, Ω, kΩ)

**Minimum Set Value :**
Adjustable between Scale Minimum and Maximum Set Value.

**Maximum Set Value :**
Adjustable between Scale Maximum and Minimum Set Value.

**Unit :**
°C, °F, bar, %RH, Hz, mA, A, mV, V, Ohm, kOhm, %, g, kg, cm, m, m/s, m/min, km/h, cm3/s, m3/h, l/s, l/min, l/h pH,EC
(Just for mA, V, mV, Ω, kΩ)

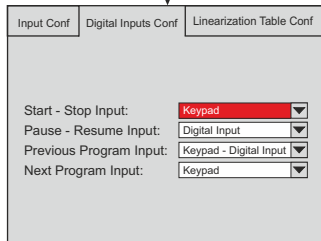**Input offset :**
Adjustable between -99 ... 99.

**Coefficient of digital filter :**
1=200ms and it is device sampling time.
Adjustable between 1 ... 32.
Value of parameter should be increased in interference.

**Decimal Point :**
According to range table ,
1, 2 and 3 digit can be selected.

**Input Conf | Digital Inputs Conf | Linearization Table Conf**

| Start - Stop Input: | Keypad |
| Pause - Resume Input: | Digital Input |
| Previous Program Input: | Keypad - Digital Input |
| Next Program Input: | Keypad |

**Digital Inputs :** Start/Stop , Pause/Resume , Next/Previous Program processes can be made by digital inputs or device keypad.
If process will be performed only by Keypad ,"Keypad" must be selected.
If process will be performed only by Digital Input ,"Digital Input" must be selected.
If process will be performed both by Keypad and Digital Input ,"Keypad and Digital Input" must be selected.
**Start/Stop : Start-Stop Input** and/or **SET** key.
**Pause/Resume : Pause-Resume Input** and/or **Back** key.
**Previous program : Previous Program Input** and/or **Increase** key.
**Next program : Next Program Input** and/or **Decrease** key.
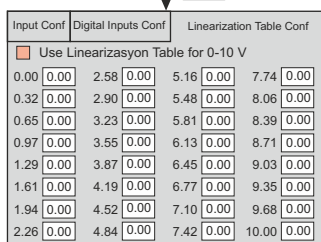
**Linearization Table Conf :**
If input type is selected as mA, V, mV, Ω or kΩ, linearizaton can be done at 32 points.

☑ Use Linearization Table for 0-10 V can be activated by pressing [  ] [  ] keys respectively.

Corresponding values of input signals must be entered to table in order to linearize at 32 points.

**Input Conf | Digital Inputs Conf | Linearization Table Conf**

☐ Use Linearizasyon Table for 0-10 V

| 0.00 | 0.00 | 2.58 | 0.00 | 5.16 | 0.00 | 7.74 | 0.00 |
| 0.32 | 0.00 | 2.90 | 0.00 | 5.48 | 0.00 | 8.06 | 0.00 |
| 0.65 | 0.00 | 3.23 | 0.00 | 5.81 | 0.00 | 8.39 | 0.00 |
| 0.97 | 0.00 | 3.55 | 0.00 | 6.13 | 0.00 | 8.71 | 0.00 |
| 1.29 | 0.00 | 3.87 | 0.00 | 6.45 | 0.00 | 9.03 | 0.00 |
| 1.61 | 0.00 | 4.19 | 0.00 | 6.77 | 0.00 | 9.35 | 0.00 |
| 1.94 | 0.00 | 4.52 | 0.00 | 7.10 | 0.00 | 9.68 | 0.00 |
| 2.26 | 0.00 | 4.84 | 0.00 | 7.42 | 0.00 | 10.00 | 0.00 |

# Programming

## Programming Outputs(Output Configuration Page)

**Output Conf** | Control Conf | Motorized Valve Conf

| | |
|---|---|
| Output Type | Relay ▼ |
| Re-Transmission | None ▼ |
| Maxmimum Analog Output Value(%) | 100 |
| Minimum Analog Output Value(%) | 0 ▼ |
| Output Hysteresis | 0 |
| Output Power Offset Around Set Point(%) | 0 |

🔁
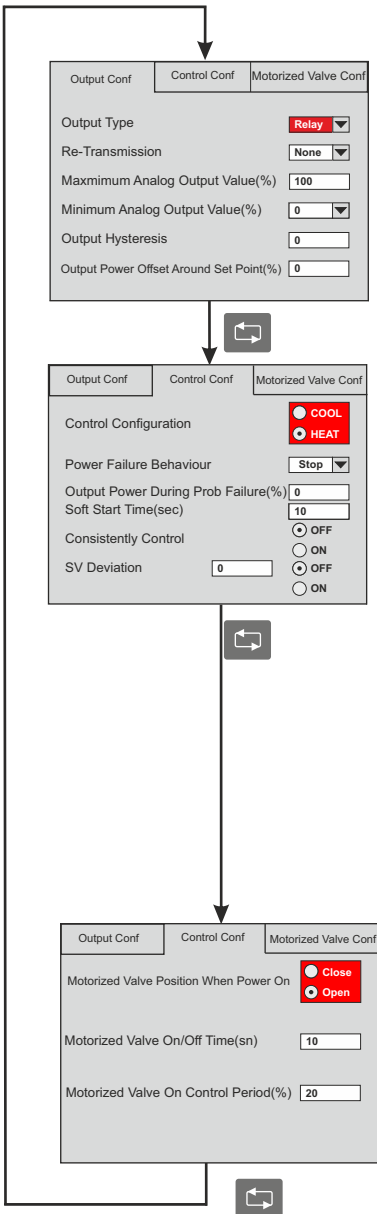
**Output Type :** Relay, SSR,Motorized Valve,0-20mA, 4-20mA or 0-10V. If relay is not selected for output type , relay can be configured as Alarm3 or motorized valve.

**Re-Transmission :** If output type is selected as relay or SSR , re-transmission can be selected as a 0/4-20mA or 0-10V. If output type is selected as a 0/4-20mA , re-transmission can be selected as a 0-10V. If output type is selected as 0-10V , re-transmission can be selected as a 0/4-20mA.

**Maximum Analog Output Value :** % maximum analog output value.

**Minimum Analog Output Value :** % minimum analog output value.

**Output Hysteresis :** Adjustable between 0... 50. **(If Proportional Band selected 0.0 , ON-OFF control and output hysteresis will be active.)**

**Output Power Offset Around Set Point :** Output power offset around SV according to error. In order to reach to SV fast.
$$TotalOuput(\%) = system\ output(\%) + (100\ /\ Proportional\ Band) * error * OutputPowerOffset/100.$$

Output Conf | **Control Conf** | Motorized Valve Conf

| | |
|---|---|
| Control Configuration | 🔴 COOL / 🔴 HEAT |
| Power Failure Behaviour | Stop ▼ |
| Output Power During Prob Failure(%) | 0 |
| Soft Start Time(sec) | 10 |
| Consistently Control | ⊙ OFF / ◯ ON |
| SV Deviation | 0 ⊙ OFF / ◯ ON |

🔁

**Control Configuration :** Selectable as Cool/Heat control. **The cooling control is only ON-OFF control (For Cooling control. Proportional Band must be 0.0).**

**Power Failure Behaviour :** If power failure occurs when profile control is running and device is powered on after power failure:
- Stop : Profile control stops and turns to initial state.
- Step : Profile control resumes from the beginning of the current step before power fail.
- Time : Finds the remaining time of the current step and completes that step.
- Temp: If the temperature decreases in case of power failure, when the device power on again, it determines which step corresponds to the current temperature (regardless of which step it was during the power cut) and calculates how much time is remaining for that step to complete. The device then continues operating from that step.

**Output Power During Prob Failure(%) :** Adjustable between %0 ... %100. Output will continue in case of prob failure.
**Soft Start Time(sec) :** Adjustable between 0 ... 200 seconds.
If device is in profile control mode , programmed segments of profile control starts according to soft start time.
If device is in "Single Setpoint Mode" , device starts to control according to soft start time after device is powered on.
**Consistently Control :** When profile control is finished ; If OFF is selected , profile control stops and turns to initial state. If ON is selected , profile control continues to control at last set value.
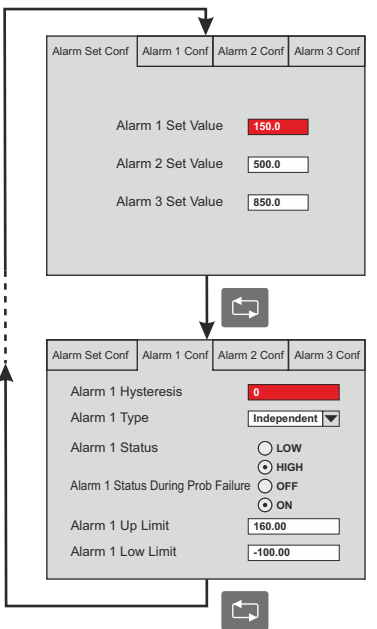**SV Deviation :** End of the every profile control step , If difference between process value and set value is bigger than SV Deviation value ( SV - PV > SV Deviation ) then time countdown is paused and control remains at last set value until difference between process value and set value is smaller than SV Deviation value ( SV - PV < SV Deviation ). SV Deviation process can be enabled/disabled with ON/OFF option.

Output Conf | Control Conf | **Motorized Valve Conf**

| | |
|---|---|
| Motorized Valve Position When Power On | 🔴 Close / 🔴 Open |
| Motorized Valve On/Off Time(sn) | 10 |
| Motorized Valve On Control Period(%) | 20 |

🔁

**Motorized Valve Position When Power On:** It provides to configuration of location of motorized valve when device power on.
**Motorized Valve On/Off Time (sn):** It can configuration between 2-300 seconds
**Motorized Valve Control Period(%):** Motorized valve configurations off time during on/off.This time gets by percent on/off time of motorized valve. If this time is less than 2 seconds,time will be 2 seconds automatically.

## Programming Alarms(Alarm Configuration Page)

**Alarm Set Conf** | Alarm 1 Conf | Alarm 2 Conf | Alarm 3 Conf

| | |
|---|---|
| Alarm 1 Set Value | 150.0 |
| Alarm 2 Set Value | 500.0 |
| Alarm 3 Set Value | 850.0 |

🔁

**Alarm 1 Set Value :** Adjustable between Alarm 1 Up Limit and Alarm 1 Low Limit.

**Alarm 2 Set Value :** Adjustable between Alarm 2 Up Limit and Alarm 2 Low Limit.

**Alarm 3 Set Value :** Adjustable between Alarm 3 Up Limit and Alarm 3 Low Limit.
(In order to use Alarm 3 , **Output Type** parameter must be different from **Relay** otherwise Alarm 3 will be unavailable and Alarm 3 Conf page will be hidden.

**Alarm 1 Hysteresis :** Adjustable between 0 ... 50.

Alarm Set Conf | **Alarm 1 Conf** | Alarm 2 Conf | Alarm 3 Conf

| | |
|---|---|
| Alarm 1 Hysteresis | 0 |
| Alarm 1 Type | Independent ▼ |
| Alarm 1 Status | ◯ LOW / ⊙ HIGH |
| Alarm 1 Status During Prob Failure | ◯ OFF / ⊙ ON |
| Alarm 1 Up Limit | 160.00 |
| Alarm 1 Low Limit | -100.00 |

🔁

**Alarm 1 Type :** Independent alarm, Deviation alarm, Band alarm, Band Alarm with Inhibition or Profil control alarm can be selected. (In order to select Profile control segment alarms , Alarm 1 segments in Alarm Conf sub page of Profile Controller Configuration Page should be selected.
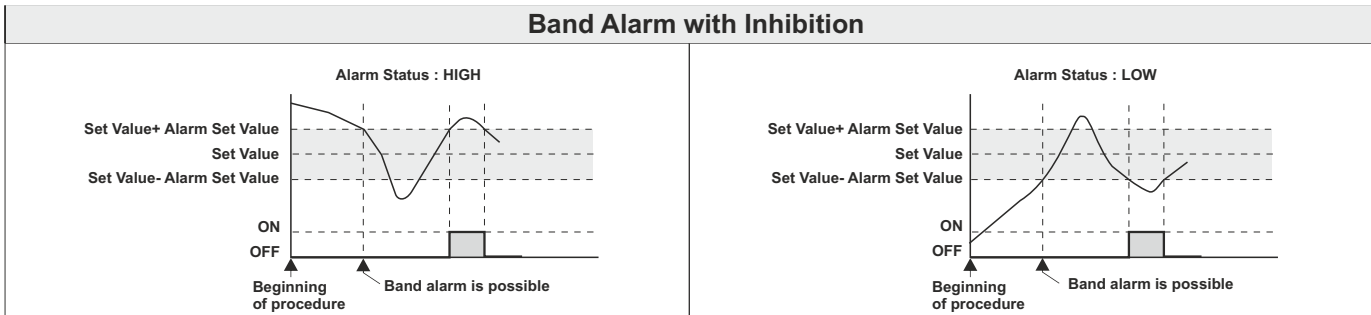
**Alarm 1 Status :** For the Independent alarm, Band alarm or Band Alarm with Inhibition to be active below the set value LOW must be selected , to be active above the set value HIGH must be selected. If LOW is seleced for Band alarm , alarm will be activated in band. If HIGH is selected , alarm will be activated out of band.

**Alarm 1 Status During Probe Failure :** For the alarm to be active in case of prob failure ON must be selected. For the alarm to be inactive in case of prob failure OFF must be selected.

**Alarm 1 Up Limit :** Adjustable between Scale Maximum and Alarm 1 Low Limit.
**Alarm 1 Low Limit :** Adjustable between Scale Minimum and Alarm 1 Up Limit.

***Alarm 2 "Alarm 2 Conf"*** and ***Alarm 3 "Alarm 3 Conf"*** *are programmed in the same way.*

## Independent Alarm

Set Value
ON
OFF
Alarm Status HIGH

ON
OFF
Alarm Status LOW

Alarm Hysteresis
Alarm Set Value

## Deviation Alarm

Set Value
ON
OFF
Alarm Status HIGH

ON
OFF
Alarm Status LOW

Alarm Hysteresis
Set Value + Alarm Set Value

## Band Alarm

ON
Set Value
ON
OFF
Alarm Status HIGH

ON
OFF
OFF
Alarm Status LOW

Alarm Hysteresis
Alarm Hysteresis
Set Value − Alarm Set Value
Set Value + Alarm Set Value

## Band Alarm with Inhibition

Alarm Status : HIGH

Set Value+ Alarm Set Value
Set Value
Set Value- Alarm Set Value

ON
OFF

Beginning of procedure
Band alarm is possible

Alarm Status : LOW

Set Value+ Alarm Set Value
Set Value
Set Value- Alarm Set Value

ON
OFF

Beginning of procedure
Band alarm is possible

# Programming

## Programming PID Control (PID Control Configuration Page)

PID Control Conf

| | |
|---|---|
| Proportional Band (%) | 4.0 |
| Integral Time (min) | 4.0 |
| Derivative Time (min) | 1.0 |
| Control Period (sec) | 4 |
| Auto Tune | ⊙ OFF  ○ ON |

Start Selftune

**Proportional Band (%) :** Adjustable between %0.0 ... %100.0.
If proportional band is selected 0.0 , ON-OFF control will be activated.
**Integral Time (min) :** Adjustable between 0.0 ... 100.0 minute.
**Derivate Time (min) :** Adjustable between 0.0 ... 25.0 minute.
**Control Period (sec) :** Adjustable between 0 ... 250 second.
**Auto Tune :** It allows to improve PID parameters after Self Tune. In normal operation, it provides the best control by automatically changing the PID parameters in case the measured value oscillates. If Auto Tune ⊙ ON is selected, it is active and the display shows AUTO TUNE RUNNING until Auto Tune is completed. Auto Tune ⊙ OFF must be selected to stop the Auto Tune operation.

**PID Self Tune :**

Self Tune is started by selecting [Start Selftune] with [▲] [▼] keys and pressing by [✎] key. SELF TUNE IS STARTED and SELF TUNE IS RUNNING messages is shown respectively.

If [↰] key is pressed, SELF TUNE IS STOPPED message is shown and selftune is stopped and device turns back to home screen.

When Self Tune process is successful:
- SELF TUNE IS FINISHED, PRESS BACK TO EXIT message is shown and waits for user intervention in profile control mode.
- SELF TUNE IS FINISHED, SINGLE SETPOINT IS RUNNING message is shown and continues to control.

In order to start Selftune process PV must be smaller than %60 of SV , otherwise SELF TUNE IS STARTED and SELF TUNE IS STOPPED messages are shown respectively and home screen returned.
User must wait until PV drops under %60 of SV and start selftune again.

## Programming ModBus (Communication Configuration Page)

Modbus Conf

| | |
|---|---|
| Modbus Communication | ○ OFF  ⊙ ON |
| Device Address | 1 |
| Baudrate | 9600 ▼ |

**Modbus Communication :** If parameter is selected ON modbus will be active , otherwise will be inactive.

**Device Address :** Adjustable between 1 ... 247

**Baudrate :** 4800, 9600, 19200, 38400 or 57600.

## Programming Keypad Security Level(Security Configuration Page)

| | |
|---|---|
| Security Code | 0 |
| Input Configuration Page Visibility | Yes ▼ |
| Output Configuration Page Visibility | Yes ▼ |
| Alarm Configuration Page Visibility | Yes ▼ |
| PID Control Configuration Page Visibility | Yes ▼ |
| Communication Configuration Page Visibility | Yes ▼ |
| Calibration Page Visibility | Yes ▼ |
| Profile Controller Configuration Page Visibility | Yes ▼ |

Enter security code in order to change page visibilities.

**Security Code :** In order to change security configuration , Security Code must be entered 123.
**Input Configuration Page Visibility :** Yes, No or None.
**Output Configuration Page Visibility :** Yes, No or None.
**Alarm Configuration Page Visibility :** Yes, No or None.
**PID Control Configuration Page Visibility :** Yes, No or None.
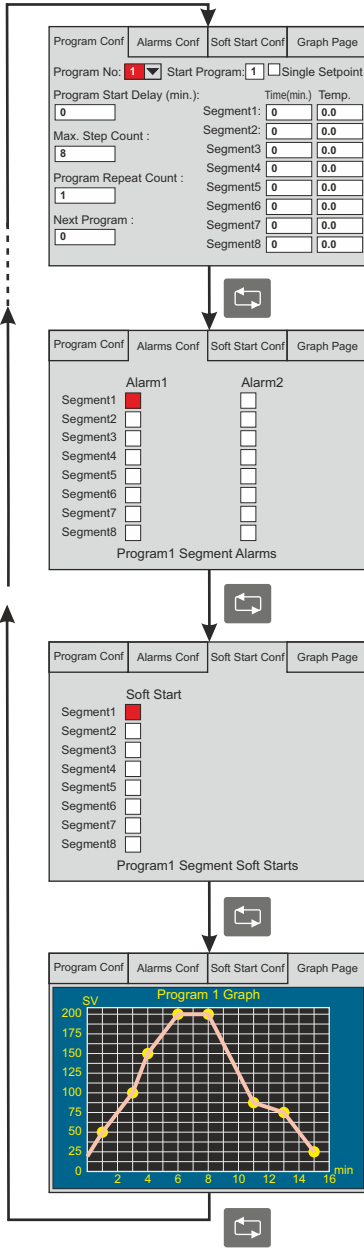**Communication Configuration Page Visibility :** Yes, No or None.
**Calibration Page Visibility :** Yes or None.
**Profile Controller Configuration Page Visibility :** Yes, No or None.

No : Page can be opened , parameters can not be changed.
Yes : Page can be opened , parameters can be changed. None : Page can not be opened.

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## Programming Profile Controller (Profile Controller Configuration Page)

**Program No :** Adjustable between 1 ... 16.

**Start Program :** Adjustable 1 ... 16.

**Single Setpoint :** If checkbox ☑ is selected , single set point will be activated.(In this case profile controller is inactive)

**Program Start Delay(min.) :** Adjustable between 0 ... 180.

**Max. Step Count :** Adjustable between 1 ... 8.

**Program Repeat Count :** Adjustable between 1 ... 8.

**Next Program :** Adjustable between 0 ... 16. If 0 is selected , control will be stopped at end of the program.

**Segment1/Time(min.) :** Adjustable between 0 ... 32000 min.

**Segment1/Temp :** Adjustable between Minimum Set Value and Maximum Set Value parameters.

**2, 3 ... 8. Segments** are programmed in the same way.

**Segment1/Alarm1 :** If checkbox ☑ is selected , Alarm1 will be activated.

**Segment1/Alarm2 :** If checkbox ☑ is selected , Alarm2 will be activated.

**2, 3 ... 8. Segments** are programmed in the same way.

If **Alarm Type** parameter is selected **profile control alarm** , Alarm1 and Alarm2 can be configured for the profile controller.

**Soft Start Conf :**

**1. Segment Soft Start :** If checkbox ☑ is selected , Soft Start will be activated.

Value of **Soft Start Time parameter** will be used as a selected segment's soft start time.

**2, 3 ... 8. Segments** are programmed in the same way.

**Graph Page :**

Configuration can be seen from Graph Page.
- Program number,
- Set values of segments
- Segment counts
- Segment lenght

## MODBUS ERROR MESSAGES

Modbus protocol has two types error, communication error and operating error. Reason of the communication error is data corruption in transmission. Parity and CRC control should be done to prevent communication error. Receiver side checks parity and CRC of the data. If they are wrong, the message will be ignored. If format of the data is true but function doesn't perform for any reason, operating error occurs. Slave realizes error and sends error message. Most significant bit of function is changed '1' to indicate error in error message by slave. Error code is sent in data section. Master realizes error type via this message.

## ModBus Error Codes

| Error Code | Name | Meaning |
|---|---|---|
| 01 | ILLEGAL FUNCTION | The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it. |
| 02 | ILLEGAL DATA ADDRESS | The data address received in the query is not an allowable address for the slave. |
| 03 | ILLEGAL DATA VALUE | A value contained in the query data field is not an allowable value for the slave. |

**Message example;**

**Structure of command message (Byte Format)**

| Device Address | | (0A)h |
|---|---|---|
| Function Code | | (01)h |
| Beginning address of coils. | MSB | (04)h |
| | LSB | (A1)h |
| Number of coils (N) | MSB | (00)h |
| | LSB | (01)h |
| CRC DATA | LSB | (AC)h |
| | MSB | (63)h |

**Structure of response message (Byte Format)**

| Device Address | | (0A)h |
|---|---|---|
| Function Code | | (81)h |
| Error Code | | (02)h |
| CRC DATA | LSB | (B0)h |
| | MSB | (53)h |

**EPC9513 PARAMETER LIST**

| PARAMETER | INFORMATION | DATA TYPE | REG. ADR. | MİN. | MAX. | DEF. |
|---|---|---|---|---|---|---|
| Input Type | 0 = B type Termokupl 1 = E  2 = J  3 = K  4 = L  5 = N  6 = R  7 = S<br>8 = T  9 = U  10 = Pt100 11= NTC 12 = 0-20 mA 13 = 4-20 mA 14 = 0-5 V 15 = 1-5 V<br>16 = 0-10 V 17 = 0-150 mV 18 = 0-550 Ohm 19 = 0-10 kOhm | Word | 0 | 0 | 19 | 2 |
| Scale Mnmum | Can not be changed for Thermocouple and PT100 . Can be changed for Unversal Inputs.<br>Scale Mnmum s -100 for PT100  XXX.XX. Low lmt for Set Value parameter. | Word | 1 | -32768 | 32767 | -1000 |
| Scale Maxmum | Can not be changed for Thermocouple and PT100 . Can be changed for Unversal Inputs.<br>Scale Maxmum s 160 for PT100  XXX.XX. Up lmt for Set Value parameter. | Word | 2 | -32768 | 32767 | 9000 |
| Unt | 0 = °C 1 = °F 2 = Bar 3 = %RH 4 = Hz 5 = A 6 = V  . | Word | 3 | 0 | 6 | 0 |
| Input Offset | Offset added to Measurement. | Word | 4 | -99 | 99 | 0 |
| Dgtal Flter Coeffcent | 1 = Fastest response tme 32 = Slowest response tme<br>Value of parameter should be ncreased n nterference. | Word | 5 | 1 | 32 | 4 |
| Decmal Pont | 0 = XXX  1 = XXX.X  2 = XXX.XX  3= XXX.XXX . Accırdng to Decmal Pont parameter , modbus read/wrte data changed by 1,10,100,1000 lnearly. | Word | 6 | 0 | 3 | 1 |
| Mnmum Set Value | Adjustable between Scale Mnmum and Maxmum Set Value parameters. | Word | 7 | 0 | 3 | 1 |
| Maxmum Set Value | Adjustable between Scale Maksmum and Mnmum Set Value parameters. | Word | 8 | 0 | 3 | 1 |
| Start - Stop Input | 0=Dsable 1= Enable<br>Profl Control start/stop dgtal nput dsable/enable. | Word | 9 | 0 | 1 | 0 |
| Pause - Resume Input | 0= Dsable 1= Enable<br>Profl Control pause/resume dgtal nput dsable/enable. | Word | 10 | 0 | 1 | 0 |
| Prevous Program Input | 0= Dsable 1= Enable<br>Profl Control prevous program dgtal nput dsable/enable. | Word | 11 | 0 | 1 | 0 |
| Next Program Input | 0= Dsable 1= Enable<br>Profl Control next program dgtal nput dsable/enable. | Word | 12 | 0 | 1 | 0 |
| Lnearzaton Table [0-31].Ponts | Lnearzaton table , value of ponts from 0 to 31. | Word | [13-44] | -32768 | 32767 | 0 |
| Output Type | 0 = Relay 1 = SSR 2 = 0-20 mA 3 = 4-20 mA 4 = 0-10 V   5 = Valve | Word | 45 | 0 | 5 | 0 |
| Re-Transmsson | 0 = None  1 = 0-20 mA  2 = 4-20 mA  3 = 0-10 V | Word | 46 | 0 | 3 | 0 |
| Maxmum Analog Output Value |  | Word | 47 | 0 | 100 | 100 |
| Mnmum Analog Output Value |  | Word | 48 | 0 | 100 | 0 |
| Output Hysteress | Adjustable between 1 and  50. | Word | 49 | 0 | 50 | 0 |
| Output Power Offset Around Set Pont(%) | Added offset(%)  accordng to error around Set Value. | Word | 50 | 0 | 100 | 0 |
| Output Power Durng Prob Falure(%) | Ajustable between %0 and %100 , output wll contnue n case of prob falure. | Word | 51 | 0 | 100 | 0 |
| Soft Start Tme(sec) | Adjustable between 0 and 200 seconds. | Word | 52 | 0 | 200 | 10 |
| SV Devaton | If (SV - PV > SV Devaton) at the end of the step and If SV Devaton s enabled , tme countdown wll be paused and control remans at last set value untl (SV - PV <  SV Devaton ) Please check parameter defnton on page 5. | Word | 53 | 0 | 32767 | 0 |
| Alarm 1 Set Value |  | Word | 54 | -32768 | 32767 | 1000 |
| Alarm 2 Set Value |  | Word | 55 | -32768 | 32767 | 1000 |
| Alarm 3 Set Value |  | Word | 56 | -32768 | 32767 | 1000 |
| Alarm 1 Hysteress |  | Word | 57 | 0 | 50 | 0 |
| Alarm 1 Type | 0 =Independent  1=Devaton 2=Band alarm 3=Band alarm wth nhbtaton 4=Profl control alarm | Word | 58 | 0 | 4 | 0 |
| Alarm 1 Up Lmt |  | Word | 59 | -32768 | 32767 | 9000 |
| Alarm 1 Low Lmt |  | Word | 60 | -32768 | 32767 | -1000 |
| Alarm 2 Hysteress |  | Word | 61 | 0 | 50 | 0 |
| Alarm 2 Type | 0 =Independent  1=Devaton 2=Band alarm 3=Band alarm wth nhbtaton 4=Profl control alarm | Word | 62 | 0 | 4 | 0 |
| Alarm 2 Up Lmt |  | Word | 63 | -32768 | 32767 | 9000 |
| Alarm 2 Low Lmt |  | Word | 64 | -32768 | 32767 | -1000 |
| Alarm 3 Hysteress |  | Word | 65 | 0 | 50 | 0 |
| Alarm 3 Type | 0 =Independent  1=Devaton 2=Band alarm 3=Band alarm wth nhbtaton | Word | 66 | 0 | 3 | 0 |
| Alarm 3 Up Lmt |  | Word | 67 | -32768 | 32767 | 9000 |
| Alarm 3 Low Lmt |  | Word | 68 | -32768 | 32767 | -1000 |
| Proportonal Band (%) | If t s set to %0.0 , ON-OFF control s actvated. If t s set to dfferent from %0.0 , PID control s actvated. In order to read/wrte from modbus mutple/dvde wth 10. For example ; n order to set %5.5 , 5.5x10=55 must be wrtten to parameter. | Word | 69 | 0 | 100 | 4 |
| Integral Tme (mn) | Adjustable between 0.0 and 100.0.<br>If t s set to 0.0 , PD control s actvated. In order to read/wrte from modbus mutple/dvde wth 10. For example ; n order to set %5.5 , 5.5x10=55 must be wrtten to parameter. | Word | 70 | 0 | 100 | 4 |
| Dervatve Tme (mn) | Adjustable between 0.0 and  25.0.<br>If t s set to 0.0 , PI control s actvated. In order to read/wrte from modbus mutple/dvde wth 10. For example ; n order to set %5.5 , 5.5x10=55 must be wrtten to parameter. | Word | 71 | 0 | 25 | 1 |
| Control Perod (sec) | Adjustable between 1 and 250 second. | Word | 72 | 1 | 250 | 4 |
| Start Program | Profle control's startng program number. | Word | 73 | 1 | 16 | 1 |
| Set Value |  | Word | 74 | -32768 | 32767 | 2000 |
| Motorized Valve Position When Power On | When device is power on, it provides to change to motorized valve position. | Bit | 75 | 0 | 0 | 1 |
| Motorized Valve On/Off Time (sn) | It can set between 2-300 seconds. | Word | 76 | 2 | 300 | 100 |
| Motorized Valve Control Period(%) | Motorized valve configurations off time  during on/off.This time gets by percent on/off time of motorized valve. | Word | 77 | 1 | 50 | 25 |

Related to Decimal Point parameter; **Scale Minimum , Scale Maximum , Linearization Table Points , Alarm 1 Set Value , Alarm 2 Set Value , Alarm 3 Set Value , Alarm 1 Up Limit , Alarm 1 Low Limit , Alarm 2 Up Limit , Alarm 2 Low Limit , Alarm 3 Up Limit , Alarm 3 Low Limit , Program Segment 1 Set Value , Program Segment2 Set Value , Program Segment3 Set Value , Program Segment4 Set Value , Program Segment5 Set Value , Program Segment6 Set Value , Program Segment7 Set Value , Program Segment8 Set Value** parameters are read/written linearly with 1,10,100,1000.

For example  ; Decimal Point parameter is 1and If Set Value is 155.5 , Set Value will be read  1555  from modbus.

## Profil Control Holding Registers

| PARAMETER | INFORMATION | DATA TYPE | REG. ADR. | MİN. | MAX. | DEF. |
|---|---|---|---|---|---|---|
| Start Delay(mn.) | Delay before program startng. | Word | 1000 + ( ProgramNo-1 ) x 20 | 0 | 180 | 0 |
| Max. Step Count | Number of segments. | Word | 1000 + ( ProgramNo-1 ) x 20 + 1 | 1 | 8 | 8 |
| Repeat Count | Repeat count of program. | Word | 1000 + ( ProgramNo-1 ) x 20 + 2 | 1 | 8 | 1 |
| Next Program | Number of next program. | Word | 1000 + ( ProgramNo-1 ) x 20 + 3 | 0 | 16 | 0 |
| Program Segment1 Tme(mn.) | Program segment1's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 4 | 0 | 32000 | 0 |
| Program Segment1 Set Value | Program segment1's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 5 | -32000 | 32000 | 0 |
| Program Segment2 Tme(mn.) | Program segment2's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 6 | 0 | 32000 | 0 |
| Program Segment2 Set Value | Program segment2's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 7 | -32000 | 32000 | 0 |
| Program Segment3 Tme(mn.) | Program segment3's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 8 | 0 | 32000 | 0 |
| Program Segment3 Set Value | Program segment3's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 9 | -32000 | 32000 | 0 |
| Program Segment4 Tme(mn.) | Program segment4's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 10 | 0 | 32000 | 0 |
| Program Segment4 Set Value | Program segment4's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 11 | -32000 | 32000 | 0 |
| Program Segment5 Tme(mn.) | Program segment5's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 12 | 0 | 32000 | 0 |
| Program Segment5 Set Value | Program segment5's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 13 | -32000 | 32000 | 0 |
| Program Segment6 Tme(mn.) | Program segment6's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 14 | 0 | 32000 | 0 |
| Program Segment6 Set Value | Program segment6's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 15 | -32000 | 32000 | 0 |
| Program Segment7 Tme(mn.) | Program segment7's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 16 | 0 | 32000 | 0 |
| Program Segment7 Set Value | Program segment7's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 17 | -32000 | 32000 | 0 |
| Program Segment8 Tme(mn.) | Program segment8's tme | Word | 1000 + ( ProgramNo-1 ) x 20 + 18 | 0 | 32000 | 0 |
| Program Segment8 Set Value | Program segment8's value | Word | 1000 + ( ProgramNo-1 ) x 20 + 19 | -32000 | 32000 | 0 |

Profil control modbus addresses start from 1000.
In order to write/read profile program parameters to/from Modbus base address is 1000 + ( ProgramNo-1 ) x 20.
Related to Decimal Point parameter Profil Control Set parameters are read/written linearly with 1,10,100,1000.
For example;
Program5 Start Delay (min.)  Holding Register Address is 1000 + (5-1) x 20 = 1080
Program5 Setment6 Time (min.) Holding Register Address is 1000 + (5-1) x 20 + 14 = 1094

## Input Registers

| PARAMETER | INFORMATION | DATA TYPE | REG. ADR. | MİN. | MAX. | DEF. |
|---|---|---|---|---|---|---|
| Measured Value | Measured PV ,  result must be dvded by 10. For example; If temperature s  32.5 °C ,  325 wll be read over modbus. | Word | 0 | NONE | NONE | NONE |
| Internal NTC Temperature | Measured Internal NTC temperature ,  result must be dvded by 10. For example; If temperature s  32.5 °C ,  325 wll be read over modbus. | Word | 1 | NONE | NONE | NONE |
| Analog Output Percentage | Output % for 0-10V , 0-20mA or 4-20mA | Word | 2 | NONE | NONE | NONE |
| Current Program number | Runnng program number whle profle controller s runnng. | Word | 3 | NONE | NONE | NONE |
| Current segment number | Runnng segment number whle profle controller s runnng. | Word | 4 | NONE | NONE | NONE |
| Control Remanng Tme(mn) | Remanng tme of runnng program | Word | 5 | NONE | NONE | NONE |

## Coil Registers

| PARAMETER | INFORMATION | DATA TYPE | REG. ADR. | MİN. | MAX. | DEF. |
|---|---|---|---|---|---|---|
| Use Lnearzaton Table | Dsable/Enable Lnearzaton table<br>Can not be used for Thermocouple , PT100 and NTC . Can be used for Unversal Inputs. | Bt | 0 | 0 | 1 | 0 |
| Control Confguraton | 0=ON-OFF COOLING  1=ON-OFF HEATING<br>If Proportonal Band parameter s %0 , ON-OFF control actvated. | Bt | 1 | 0 | 1 | 1 |
| Power Falure Behavour | 0= Stop  1= Resume<br>If power falure occurs when profle control s runnng and devce powered on after power falure;<br>If stop s selected , profle control wll stop and turn to ntal state.<br>If resume s selected , profle control wll resume from where t stopped. | Bt | 2 | 0 | 1 | 0 |
| Consstently Control | 0 = OFF , profle control stops and turns to ntal state.<br>1 = ON , profle control contnue to control at last set value. | Bt | 3 | 0 | 1 | 0 |
| Sv Devaton Enable | 0 = OFF , 1 = ON | Bt | 4 | 0 | 1 | 0 |
| Alarm 1 Status | 0= LOW 1= HIGH | Bt | 5 | 0 | 1 | 1 |
| Alarm 1 Status Durng Prob Falure | 0=OFF , alarm s nactve n case of prob falure.<br>1=ON  , alarm s actve n case of prob falure. | Bt | 6 | 0 | 1 | 1 |
| Alarm 2 Status | 0= LOW 1= HIGH | Bt | 7 | 0 | 1 | 1 |
| Alarm 2 Status Durng Prob Falure | 0=OFF , alarm s nactve n case of prob falure.<br>1=ON  , alarm s actve n case of prob falure. | Bt | 8 | 0 | 1 | 1 |
| Alarm 3 Status | 0= LOW 1= HIGH | Bt | 9 | 0 | 1 | 1 |
| Alarm 3 Status Durng Prob Falure | 0=OFF , alarm s nactve n case of prob falure.<br>1=ON  , alarm s actve n case of prob falure. | Bt | 10 | 0 | 1 | 1 |
| Auto Tune | 0 = OFF  1 = ON , Improve PID parameters whle selftune s runnng. If PV s oscllatng whle<br>profle control s runnng , autotune wll mprove PID parameters n order to best control. | Bt | 11 | 0 | 1 | 0 |
| Sngle Set Pont | 0 = OFF  1 = ON | Bt | 12 | 0 | 1 | 0 |
| Functon Col Start/Stop | Profle control can be started/stopped over modbus. If user wrte 1 to ths col , profle controller wll start/stop. | Bt | 100 | 0 | 1 | 0 |
| Functon Col Pause/Resume | Profle control can be paused/resumed over modbus. If user wrte 1 to ths col , profle controller wll pause/resume. | Bt | 101 | 0 | 1 | 0 |
| Functon Col Next | Profle control can start next program over modbus. If user wrte 1 to ths col , profle controller wll start to next program. | Bt | 102 | 0 | 1 | 0 |
| Functon Col Prevous | Profle control can start prevous program over modbus. If user wrte 1 to ths col , profle controller wll start to prevous program. | Bt | 103 | 0 | 1 | 0 |

## Discrete Input Registers

| PARAMETER | INFORMATION | DATA TYPE | REG. ADR. | MİN. | MAX. | DEF. |
|---|---|---|---|---|---|---|
| C/A3 Output Status | Control Relay / Alarm3 output state( 0 = OFF , 1 = ON ) | Bt | 0 | NONE | NONE | NONE |
| A1 Output Status | Alarm1 output state( 0 = OFF , 1 = ON ) | Bt | 1 | NONE | NONE | NONE |
| A2 Output Statıs | Alarm2 output state( 0 = OFF , 1 = ON ) | Bt | 2 | NONE | NONE | NONE |
| SSR Output Status | SSR output state( 0 = OFF , 1 = ON ) | Bt | 3 | NONE | NONE | NONE |
| Profle Controller Runnng Status | Profl controller run state( 0 = OFF , 1 = ON ) | Bt | 4 | NONE | NONE | NONE |
| Profle Controller Pause Status | Profl controller pause state( 0 = OFF , 1 = ON ) | Bt | 5 | NONE | NONE | NONE |
| Prob Falure Status | Prob falure( 0 = OFF , 1 = ON ) | Bt | 6 | NONE | NONE | NONE |