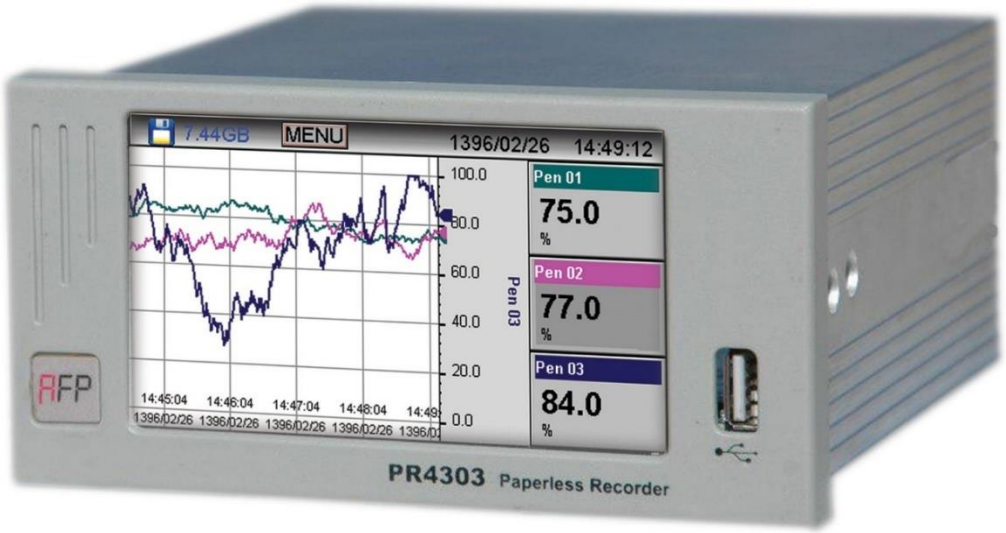
User guide of paperless recorder

PR4303



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Introduction

Paperless recorder PR4303 is used to measure, display and record the values of industrial signals such as thermocouples, thermos resistant, mA, millivolts, volts, frequencies and binary values.

Hardware features

- 4.3-inch colored screen with resistive touch screen
- RS-485 serial port
- Supply 80 ~ 260 VAC or 9 ~ 36VDC
- Metal box with dimensions of 144mm * 72mm or 72mm * 144mm
- Up to three 24-bit universal input channels with 2KVDC three-way electrical isolation
- Two relay outputs (with SSR or OPEN COLLECTOR)
- An analog output (mA)

Software features

- View data in different ways (vertical and horizontal graphic, digital and bar graph)
- Accurate calculation of Total amount for each function
- Solar Hijri and AD clock
- Ability to formulate (support various mathematical functions)
- PID controller for controlling industrial processes
- Connect to the MODBUS network
- Connect to a dedicated OPC UA Server
- Enable and disable digital outputs by using mathematical formulas
- Software Input / Output Calibration

Usage:

This device can be used individually or in groups in industrial systems, including:

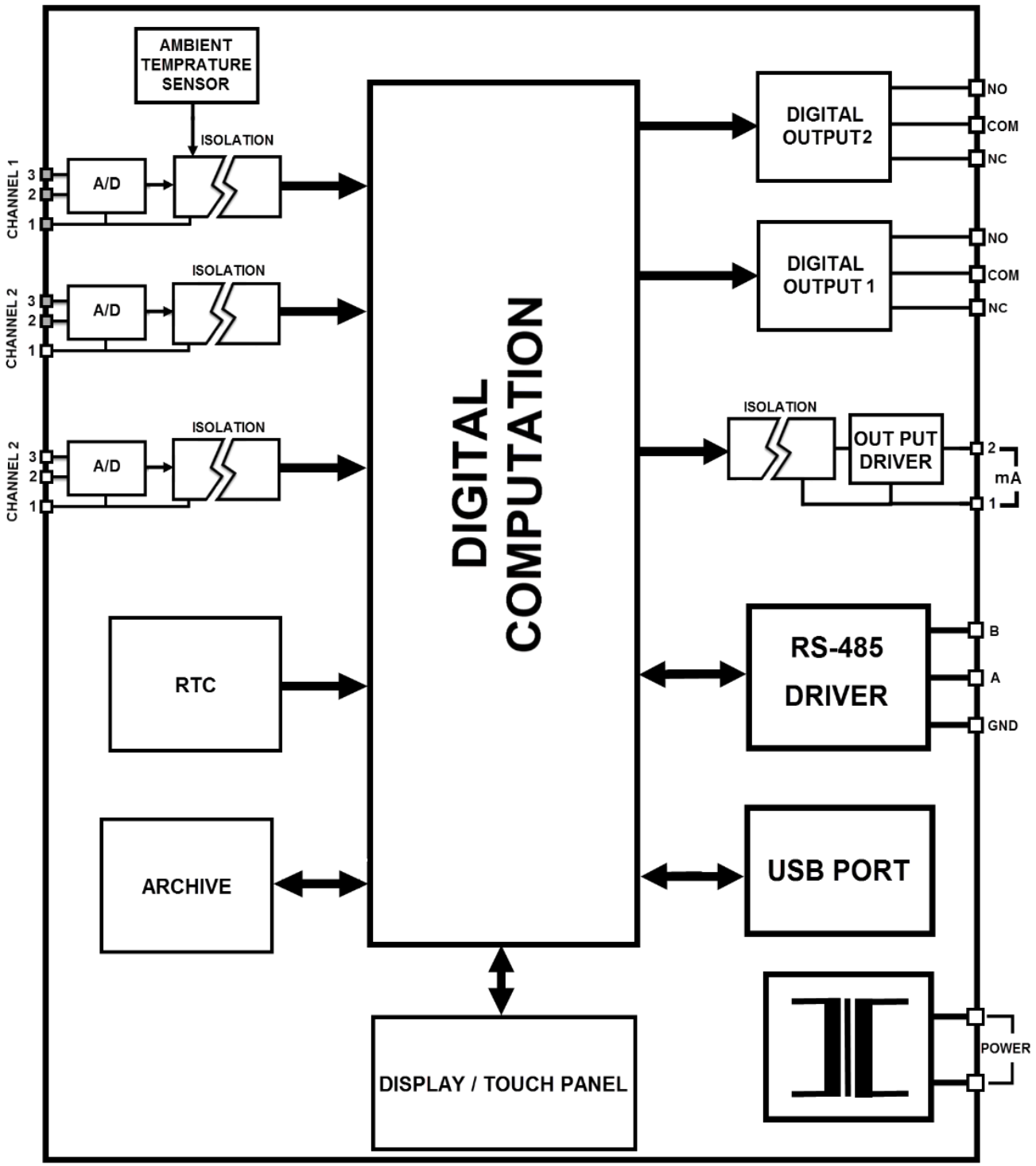
- Record industrial process data

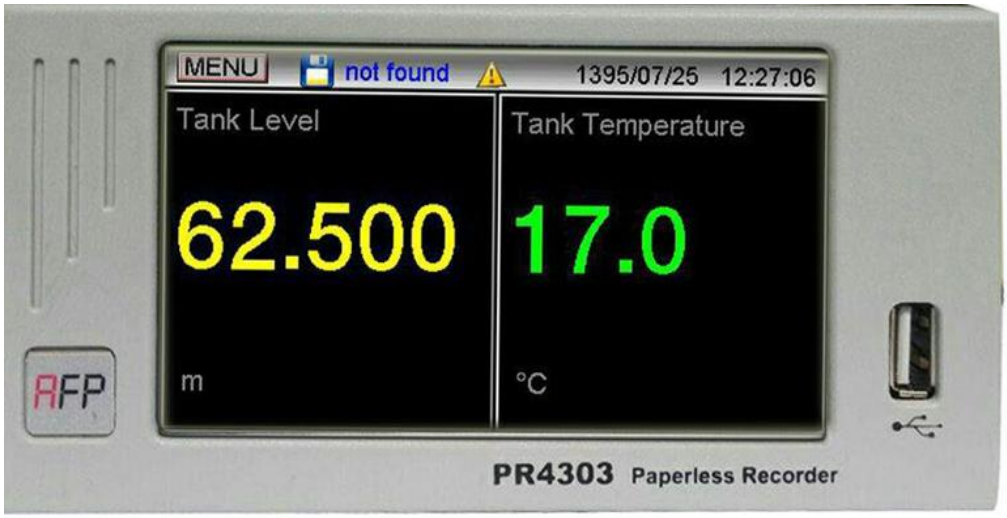
- Flow measurement for liquids and gases
- Record and measure the values of oxygen sensors (and various sensors)
- Measure and display Total
- Conductivity measurement
- And, …

Device diagram block

As shown in the figure below, the device consists of the following parts:

- Three Universal Input Channels
- two digital output channels (relay or ssr or OPEN COLLECTOR)
- An analog Output Channel (mA)
- RS485 serial port
- Computation and control section
- Screen and touch screen
- USB port
- Power supply


AMBIENT TEMPRATURE SENSOR
ISOLATION
CHANNEL 1
3
2
1
A/D
ISOLATION
CHANNEL 2
3
2
1
A/D
ISOLATION
CHANNEL 2
3
2
1
A/D
DIGITAL COMPUTATION
RTC
ARCHIVE
DISPLAY / TOUCH PANEL
DIGITAL OUTPUT2
NO
COM
NC
DIGITAL OUTPUT 1
NO
COM
NC
ISOLATION
OUT PUT DRIVER
2
1
mA
RS-485 DRIVER
B
A
GND
USB PORT
POWER



Screen view (front of the device)

Image of the back of device and connectors

System function

Analog input of the device

This section is able to measure various types of common industrial signals. The following figure shows how to connect different types of signals to the device's input connector.

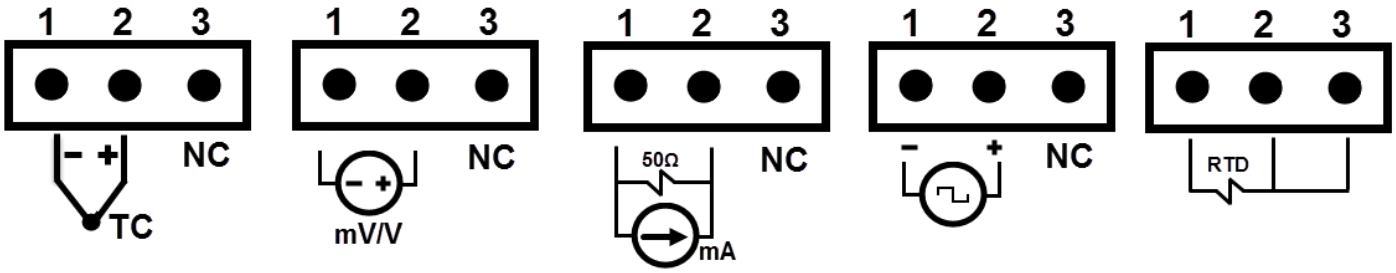
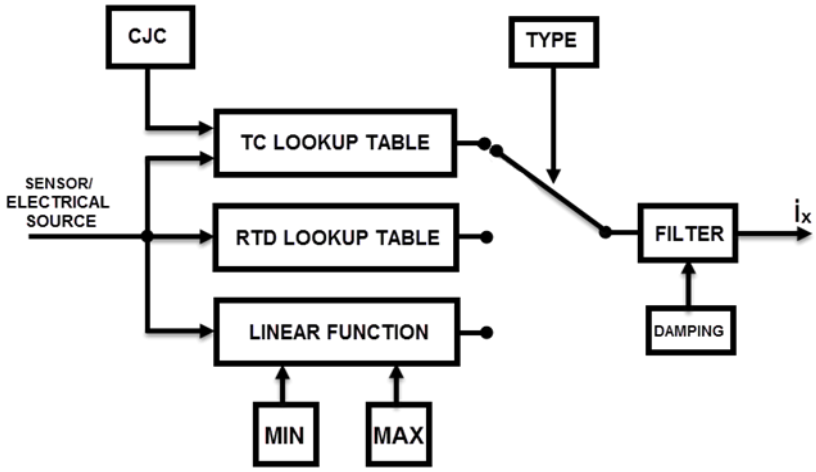


Figure 1-1: How to connect different signal types to the input connector

Channel number 1 has an ambient temperature measurement sensor (T_a). The value T_a can be used as a cold point when measuring the temperature by the thermocouple. Figure 2-1 shows the internal diagram of an input channel.



Each channel measures the sensor's value (millivolt, volt, mA, frequency) and, depending on the type of connected sensor, the thermocouple table, the thermo-static table, or the linear equation defined by the Min and Max parameters, calculates the main temperature. Then this value of the digital low pass filter is

fixed, which is set by the cooling parameter then passes to eliminate the potential adverse fluctuations existing on the signal. The final output of the channels named I1 to I3 is named for channels 1 through 3, respectively.

When using a thermocouple, to get the correct amount of temperature, we need the cold spot temperature (CJC). The CJC value is calculated from the equation that will be defined for the CJC equation.

If the thermocouple wires come straight to the back without changing the wires, then the CJC equation should be equal to T_a. Otherwise, another equation must be used.

Computation and control section

This is the main part of the device, built by the powerful ARM processor. There are various responsibilities in this section. These tasks include:

- Display data on screen in different modes
- Receive commands through the touch screen and process them
- Receive numeric values generated in each channel and process them
- Receive orders from the serial port and send a reply to the requester
- Record data in the device database
- Output update (analogue and digital)
- Exchange information via USB port

The variables displayed numerically on the screen, or shown as graphs and bar graphs, are computed in this section and are named by the pen name. There are twelve pens in this device and are available as P1, P2 and P3.

Each pen has parameters that define its attributes. These parameters are:

- Pen Size: This parameter specifies the pen type thickness when plotting the graph.
- Decimal digits: The number of digits that are displayed.
- Color: This parameter specifies the color of each pen.
- Name: This parameter specifies the name of each pen, which is usually the same as the name of the signal in the industrial process.
- Unit: This parameter specifies the unit of each pen, such as Kg / hour or M3 / min.

- Max and Min: These parameters limit the amount of variation of each pen when drawing a graph or display a bar graph.
- HH, H, L, LL: These parameters display the range of alarms in each pen. They are available for each pen like these: (H_1, …, H_{12}), (L_1, …, L_{12}), (HH_1, …,HH_{12}), (LL_1,…, LL_{12})
- Set point: This parameter specifies the value of the set point for the PID controller.
- Pen equation: By this parameter, the equation defining the pen is specified. This equation is defined by various mathematical functions based on various variables and constant numbers.

Alarm Levels for Pen:

If the instantaneous value of a pen is between values L (Low) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a pen is greater than H or lower than L, we will be in a warning status.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in warning status.

Note: When defining the equation of a pen, you can use the previous value obtained from the same formula. For example, if the P1 + 1 equation is used for P1, P1 will increase the value of one unit in each period of the calculations.

Calculation period:

The calculations are carried out on the device periodically and the following steps are performed in each period (the period of calculation is one second):

- Reading the measured values of each channel (I1, I2 and I3) from Channel 1 to 3, respectively
- Calculates the value of each function (F1, F2 and F3) from function 1 to 3, respectively
- Calculate the amount of each pen (P1, P2, and P3) from pen 1 to pen 3, respectively
- Check the active conditions and deactivate digital outputs from relay 1 to 2 (first, the condition of activation is examined).

- Analog output update

Note: When defining functions for each pen or relay or CJC equation, attention is required in the order of calculations.

Order the operation applied on the input and convert the input to pen:

As shown in Figure 5-1, for each input value of Input1 and Input2 and Input3, two min and max values are set manually in the setting menu, in the submenu of input menu. In this case, the values of each font are scaled between min and max values and are stored in variables I1, I2, and I3.

Note: As you know, the output of the thermocouple is based on the degree of centigrade, so there is no need to enter the values of Min and Max.

Note: The order in which the calculations are performed are read in the first step and are stored in variables I1, I2, and I3. Then the function values (variables F1, F2 and F3) are calculated, then the amount of pen (variables P1, P2 and P3) is calculated and this operation is performed sequentially once in a second.

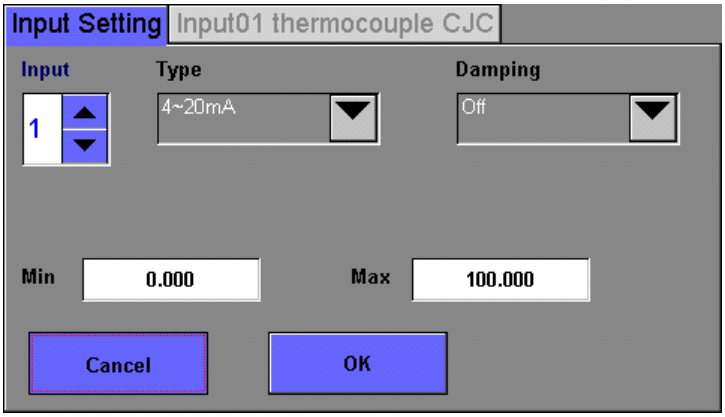


Figure 1-3: Input menu

In the Setting menu in the submenu of function, as shown in Figure 6-1, the values I1, I2 and I3 are converted to F1, F2, and F3 by default by using the formulas that are available in the Function-equation section.

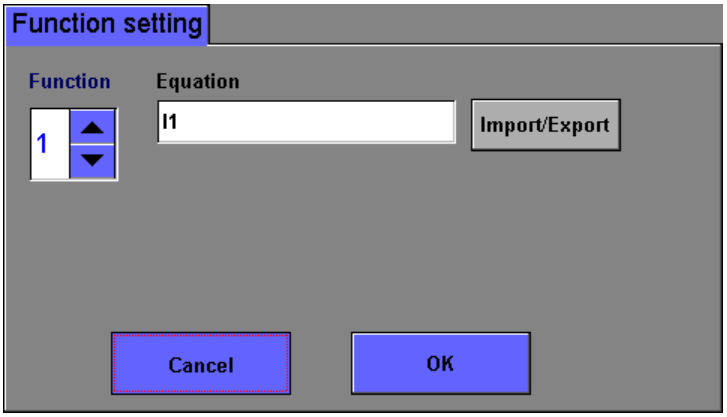


Figure 1-4: Function menu

Note: If the function-function equation uses F1, F2, and F3 itself, due to the calculations performed sequentially and at specified time intervals (once every second), the stored value in F1, F2, and F3 functions in the previous period (One second before) is used in new calculations.

- In the Setting menu, in the submenu of pen, the values of the F1, F2, and F3 variables are converted to F1, F2, and F3 using the formulas in the Pen-equation section, as shown in Figure 5-1.

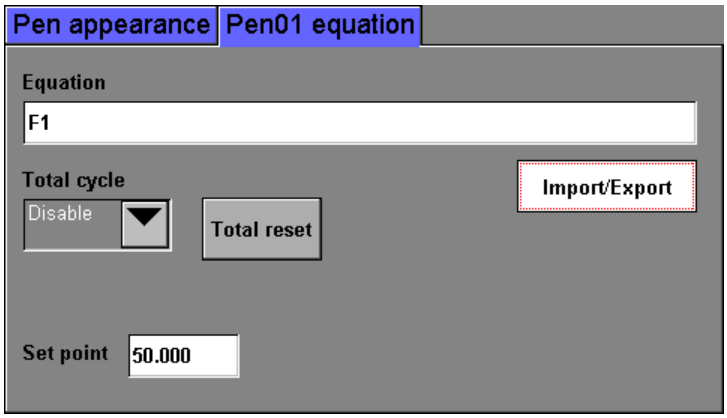


Figure 1-5: the submenu of pen

Note: If in the Pen-equation section, the variables themselves (P1, P2 and P3) are also used, due to the calculations performed sequentially and at specified time periods (once every second), then the stored value in (P1, P2 and P3) in the previous period (one second before), are used in new calculations. Finally, the values (P1, P2 and P3) are scaled between min and max, and displayed as horizontal trend, vertical bar graph, horizontal bar graph, single indicator, group indicator and black indicator.

In the Pen appearance tab, the characteristics of each pen, the number of decimal places, the size of the pen, the color of the pen, the name of the font, the unit, and The min and max values are set, according to Figure 6-1. Also, for each pen, values are set to HH and H, LL and L, which specify the allowed range of pens. Unauthorized limits for fonts are displayed as alarms; so that if the value of a pen exceeds a value of H more or be less than L, we will be in the yellow warning state, and if the value of the pen will be higher than HH value, or less than LL, we are in red warning state.

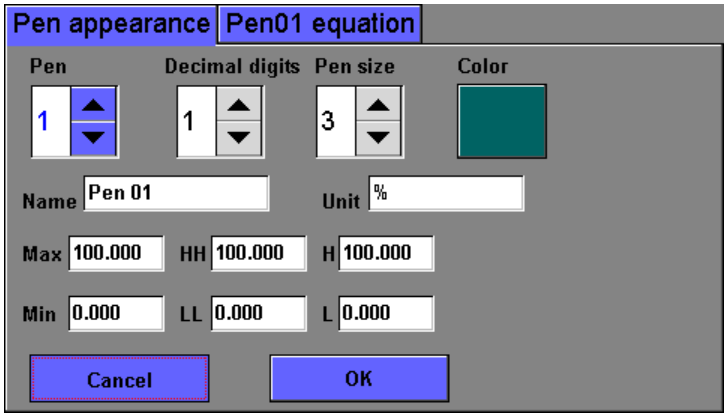


Figure 1-6: Pen appearance tab

Note: If you want to set one of the pens as analog output, select the Analog output menu according to Figure 9-1 in the Setting menu. Through the Assigned pen section, we refer to one of the analog outputs of one of the pens (P1, P2, and P3) by output. Through the Type section, the output power range can also be adjusted. Then the value of the selected font between the min and max values set by ourselves is scaled and used as the analog output.

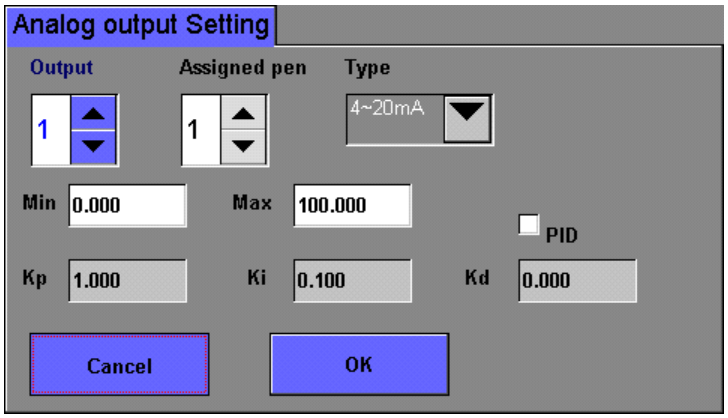


Figure 1-7: Analog output menu

As shown in figure 1-10, if you need a PID controller, by activating the corresponding checkbox, the K_p, K_i and K_d are adjustable, which is explained in the section on the attachment on the ... page.

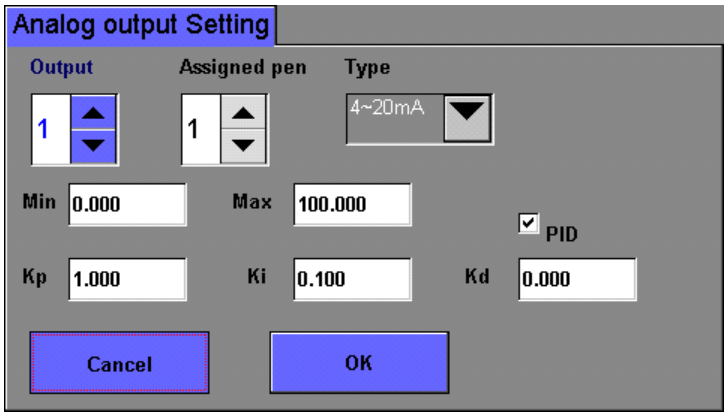


Figure 1-8: Activate the PID Controller

The relationship between Input, I, F and P:

As mentioned, to convert an Input to I, the Inputs are scaled between min and max, and converted to I. (Except for the input of the thermocouple or RTD).

To convert I to F, use the Function-equation function and use the Pen-equation to convert F to P. In the Function-equation, by default, the values of I are directly equal to F, and in the Pen-equation section, by default, the values of F are directly equal to P. Otherwise, you can use existing formulas. The notable point about using these formulas is that you can use all of the variables Input, I, F, and P in the formulas, given the fact that if these variables are used, the last stored value Used in the variable in the previous period, in the past one second.

Note: The order in which the calculations are carried out are read in the first step of the inputs and are stored in variables I1, I2, and I3. Then the value of the functions (variables F1, F2 and F3) is calculated, then the value of the fonts (variables (P1, P2, and P3) are calculated and these operations are performed sequentially once in a second.

Example: In this example, in Function-equation, we put F2 equal to sin (F2) + 3 * P3 + I2.

It should be noted that the variables F2, P3 and I2 are the last stored value of the previous period (one second before).

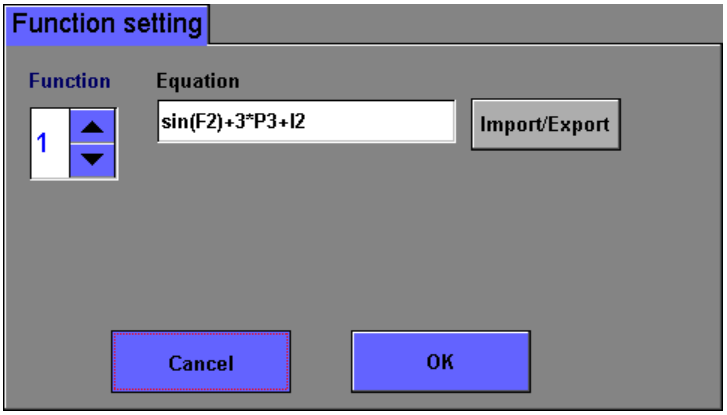


Figure 1-9

Example: In this example, in the Pen-equation section, we set the value of P3 equal to tan (I3) + avg (P2, P1) + sqrt (F2).

It should be noted that the F2, P2, and I3 variables are the last stored value of the previous period (one second before).

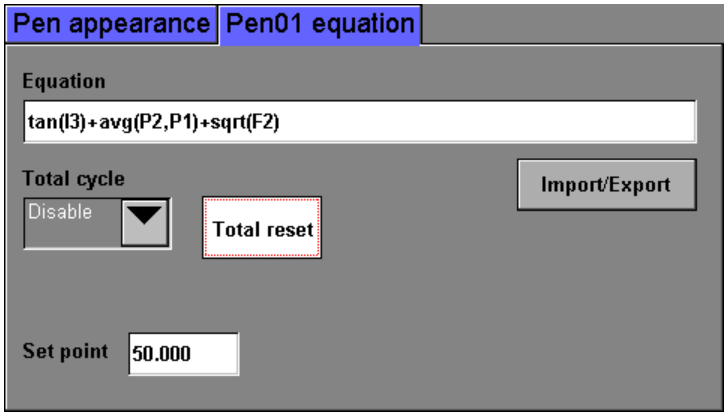


Figure 1-10

Analog output

The block diagram of the analog output section is shown in Figure 1-11. Analog output is based on milliamp. This value is calculated based on the settings for this section. Also, by activating the PID unit, you can use this section (output unit) to control a process.

Note: If the type is one of the types 0 ~ 20mA or 0 ~ 5mA, when the corresponding PEN value is NA, the analog output is "0.000mA" and if the type is one 4 ~ 20mA, when the corresponding PEN value is NA, analog output is "2.000mA".

Parameters related to this section are:

- Assigned PEN: This parameter determines the effective pen in the calculations of this section.
- Type: This parameter is determined by the analog output type and can be displayed in three modes: 4 ~ 20 mA 0 ~ 20 mA and 0 ~ 5 mA.

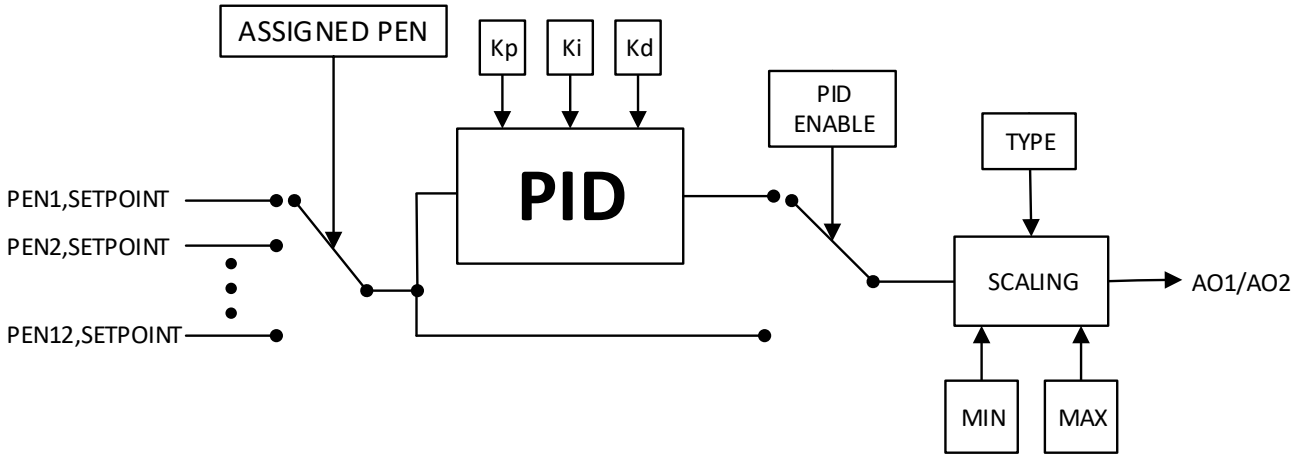


Figure 11.1: Block diagram of the analog output section

- Min, Max: By these two parameters, the output range of the mA signal is set.
- PID: If this parameter is activated, the analog output value will be updated based on PID calculations, with regard to the Set point and Kp, Ki and Kd parameters, and the current value of the selected pen.

Note: The output value of this section (analog output) will be available as AO1.

Example: By setting the parameters of the output section as follows, the output from type 4 to 20 milliamp is defined and dependent on the PEN1 equation. The output current range (4 to 20 milliamps) will be from 0 to 100 steps (SCALE).

Assigned PEN→1

Type→4~20 mA

$Min \rightarrow 0$
$Max \rightarrow 100$

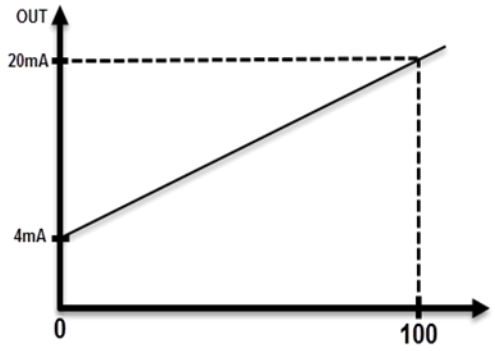


Figure 1-12: Output current range (4 to 20 milliamps) between 0 and 10

Digital output (relay):

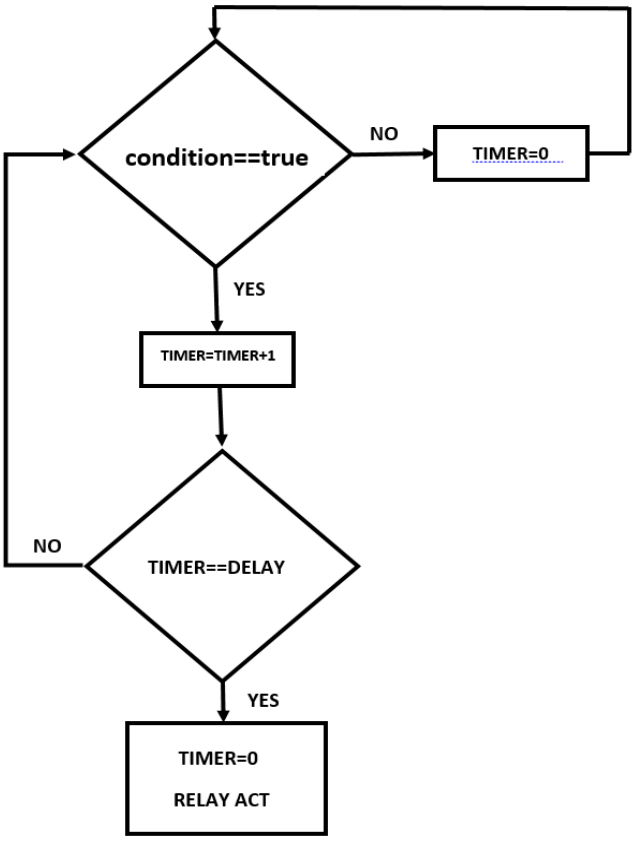


Figure 1-13: Flowchart of how to function digital output (relay)

This section is responsible for turning on or off the digital output (relay, SSR, OPEN, and COLECTOR) and acts as Figure 1-13.

First, the condition defined for One Condition is investigated. If this condition is present, the relay closing timer starts counting, and if the value of this timer reaches the On delay, the relay will light up. If the On Condition is not satisfied, the timer will be switched on and reset.

Further, if the relay condition was not satisfied, the condition for shutting off the relay is checked. If this condition is met, the timer is switched off and the relay starts counting. If the timer reaches the Off delay, the relay will turn off. If the condition is not satisfied, the shutdown timer resets. The outputs of this section, called R 1 to R 3, are available for relays 1 to 3, respectively.

Note: Digital output timers increase by one unit per second.

Note: If ON CONDITION and OFF CONDITION are activated simultaneously, the condition of ON CONDITION is priority.

Menu structure

To access the menu, press the MENU button at the top of the screen as shown in Figure 1-16.

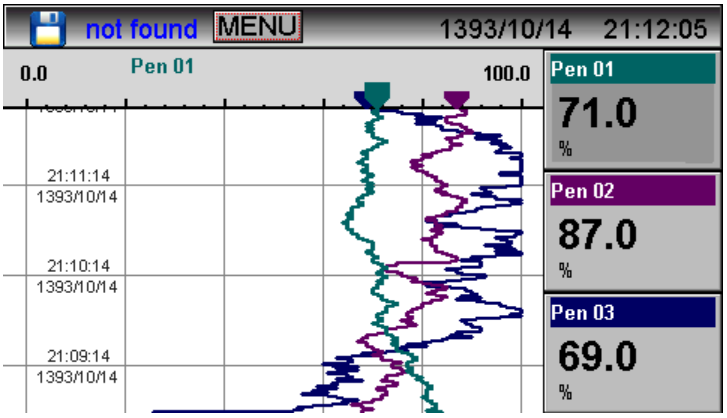


Figure 1-14: Login to device menu

After touching the button, the device menu is visible that it has 6 different parts in order to work with the device.

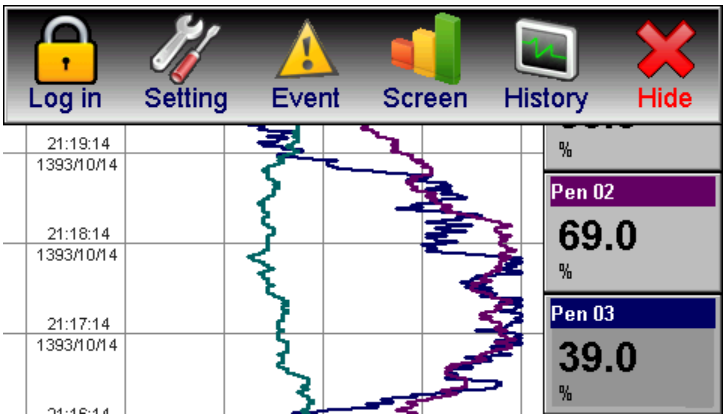


Figure 1-15: device menu

- Log in: This section is used to enter the user at different levels of access.
- Setting: This menu is used to view and change the settings of the device. The level of access to this section is fully explained in the Log In menu chapter.
- Event: Here are the events that are created in the system.
- Group: This menu consists of three groups, through which you can access the channels that were assigned to each group in the Setting menu in the submenu of Group.
- Screen: In this menu, a variety of display pages can be seen on this device.
- History: This menu is used to view changes in device pens.
- Hide: Touching this button closes the menu.

User access

Log in menu:

To log into the system and access to different menus as defined by the toolkit, the login menu is used which is shown in figure 2-1.

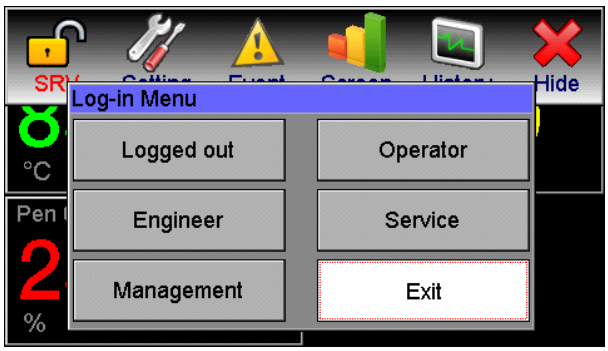


Figure 1-2: Login to the Log in menu

There are three types of user modes with different access levels:

- Operator: In this type of user, the access level is limited, and the user can only view the data and has no access to device settings. The available menus in this mode are:

1. *Event*
2. *Screen*
3. *History*

Username and password in the device's default for this user mode are OPR and OPR.

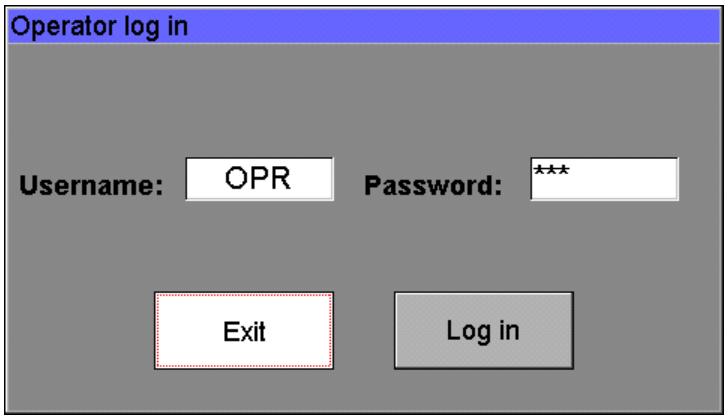


Figure 2-2: Default user name and password for the operator

- Engineer: In this user mode, there is no access to the device's important settings, and the user can only access the Clear graph, RTC, Back light, preferences, Communication, and Group sections of the Setting menu in addition to the menus that are listed in the Operator Mode. The default username and password for this device are ENG and ENG.

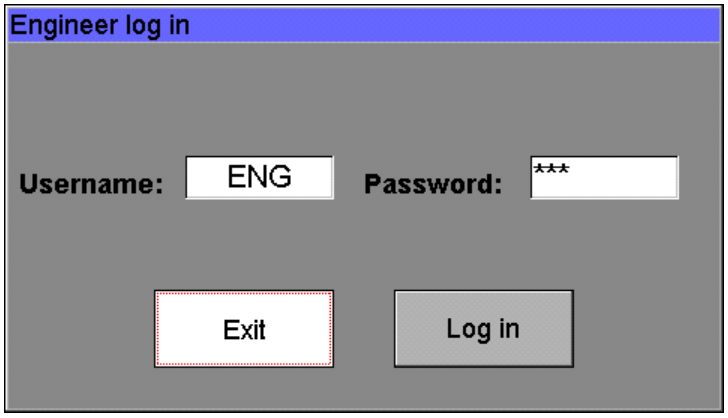


Figure 3-2: Default user name and password for Engineer

- Service: In this user mode, access to all parts of the menu is possible. There is also the possibility of managing existing users or defining a new user.

The default username and password for this device are SRV and SRV.

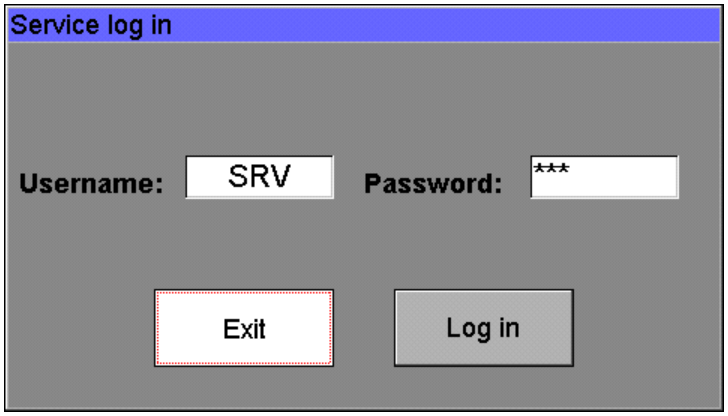


Figure 4-2: Default username and password for Service

- Management: In this section, the service user can manage users defined on the device.

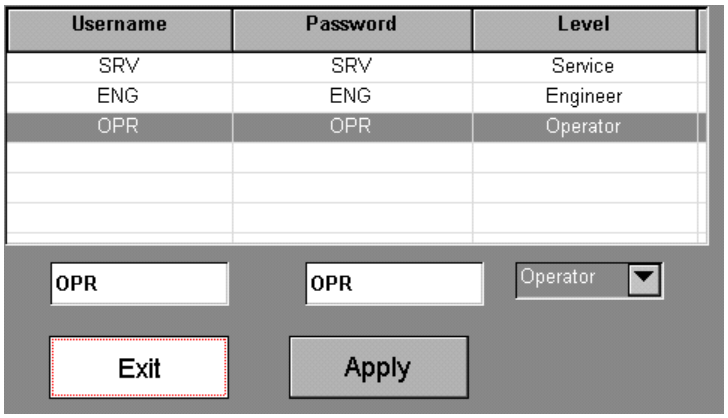


Figure 2-5: Management page

Setting

Setting menu:

In this section you can do all the settings for the device. Go to the Setting menu through the top menu shown in Figure 1-9. And the setting of various parameters through this submenu will be visible and adjusted.

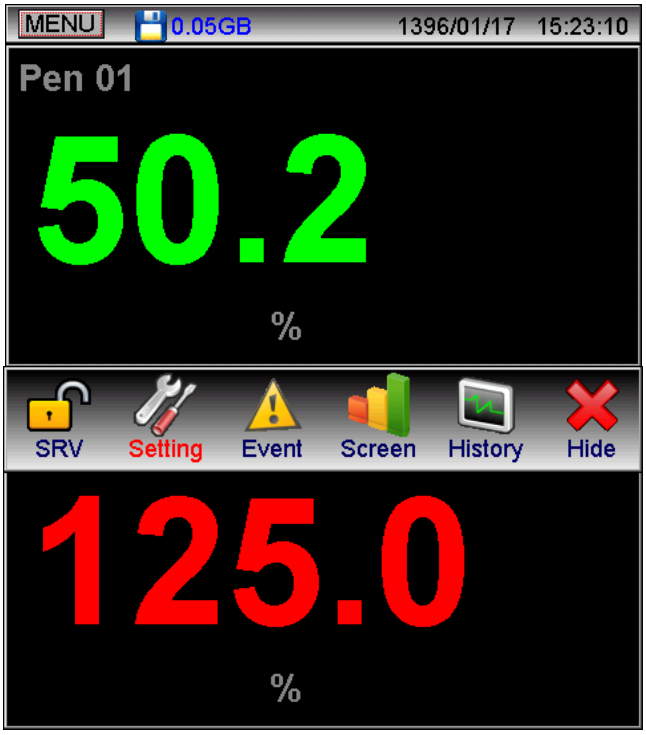


Figure 3-1: Login to device menu

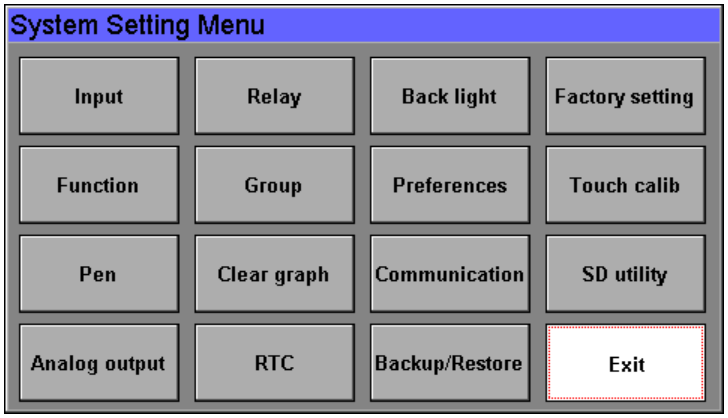


Figure 3-2: Setting menu

Note: To access all device settings, the user must be logged on to the Service level. If it is logged on to the Engineer level, it will only have access to the Group, Clear graph, RTC, Backlight, Communication settings, and if it is not at the Operator level, it will not have permission to enter the settings menu.

Now we have an introduction about some of the parameters in the submenu of Setting.

Input:

In this section, you can do all the settings for the input signals of the device. Figure 3.3 illustrates this menu. This section consists of two parts:

1. **Input setting menu**

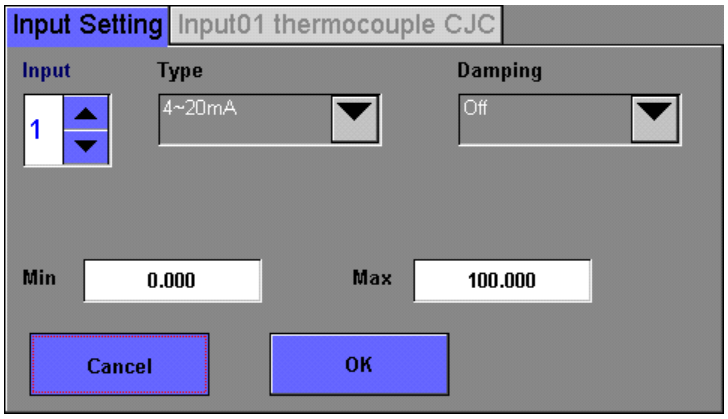


Figure 3-3: Input setting menu

- **Input:** Select the input signal from the Input option. Once the channel is selected, the selected channel data will be displayed to you. In the PR4306 model there is a possibility to connect up to 6 input signals to the device.
- **Type:** Select the desired type from the Type drop-down menu to set the input signal type. Types of thermocouples, volts, millivolts, milliamps and ... can be selected.
- **Damping:** In order to eliminate the adverse fluctuations available on the input signal, a low pass filter is considered for each entry. To activate this coefficient, you can reduce the fluctuation by selecting the Damping drop-down menu, by choosing a time-out of 1 to 10 seconds.

Note: If the Damping is Off, the filter will be deleted and, with a higher damping factor, the amount of signal fluctuation will be increased and, instead, the response to the input changes will be slower.

- **Min:** To set the minimum value of an input channel, the required amount is applied here.
- **Max:** To set the maximum value of the input channel, the required value is applied here.

Note: As you know, the output of the thermocouple is based on the degree of centigrade, so there is no need to enter the values of Min and Max.

Note: If the type of input channel is thermocouple type, the CJC thermocouple input tab is activated.

2. Input thermocouple CJC tab

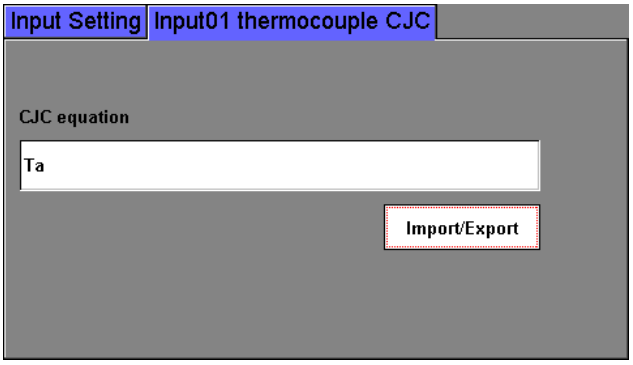


Figure 3-4: Input thermocouple CJC tab

Here you can adjust the settings for calculating the temperature of the cold spot temperature of the CJC thermocouple. When using a thermocouple, CJC is required to obtain the correct temperature value. The CJC value is calculated from the equation that will be defined for the CJC equation.

Note: If the thermocouple wires come straight to the back of the device without changing the shape of the wires, then the CJC equation should be equal to Ta. Otherwise, another equation must be used. To transfer this formula to another device by pressing the Import / Export button, the formula text that is selected in the txt file is stored on the USB flash memory. This button is also used to use equations that are located on another device or using a computer to transfer to a device in a file with a txt suffix.

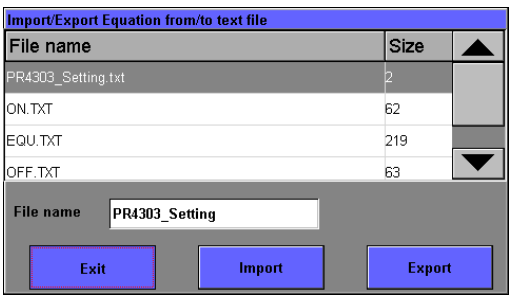


Figure 3-5: Import/ Export in Import thermocouple CJC tab

Note: The maximum number of characters for this equation is 64.

Note: The output values for this section are available as I1, I2, and I3.

Note: To make changes before leaving, you must press the OK button.

Function:

In this section, three functions F1, F2 and F3 are mathematically defined. It should be noted that the output values of these functions are updated after reading and calculating inputs I1, I2 and I3.

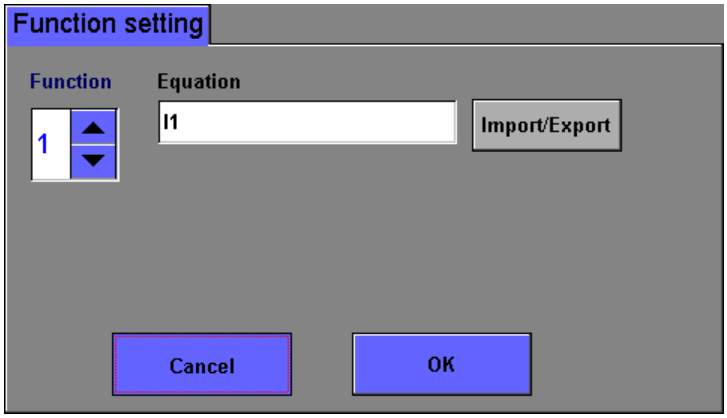


Figure 3-6: Function setting

- **Function:** In this section, the desired function is selectable.
- **Equation:** In this section, the formula for the selected function is set.
- **Import/ Export:** To transfer this formula to another device by pressing the Import / Export button, the formula text that is selected in the txt file is stored on the USB flash memory. This button is also used to use equations that are located on another device or using a computer to transfer to a device in a file with a txt suffix.

Note: The maximum number of characters for this equation is 255.

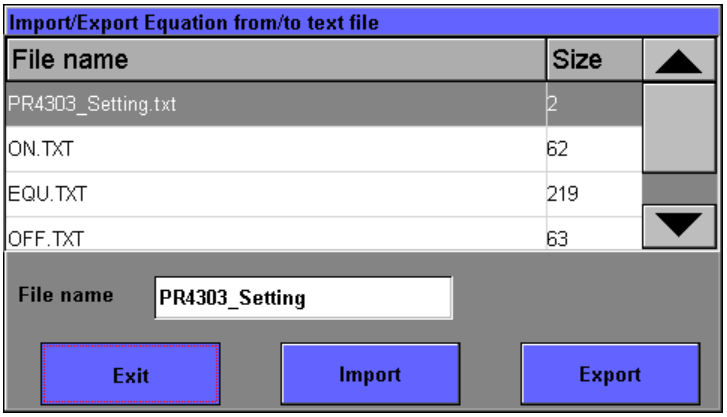


Figure 3-7: Import/ Export in Function

Note: The outputs of this section, called F1, F2 F3, will be available.

Note: To make changes before leaving, you must press the OK button.

Pen:

Here you can find all the settings for the variables that are displayed numerically on the screen or in the form of graphs and bar graphs and are named with the pen name.

1. **Pen appearance tab**

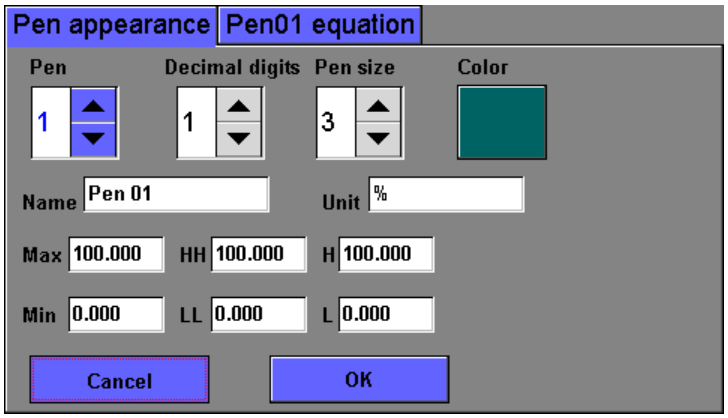


Figure 3-8: Pen appearance tab

- **Pen:** The pen can be selected from the pen option (1 to 3). Once selected, the item's pen data will be displayed to you.

- **Decimal digits**: This parameter specifies how many decimals should be used when displaying the numeric font. For example, if number 2 is selected, the font number will be displayed with two decimal places.
- **Pen Size:** This parameter specifies the thickness of the pen type when plotting the graph.
- **Color:** This parameter specifies the color of each pen.

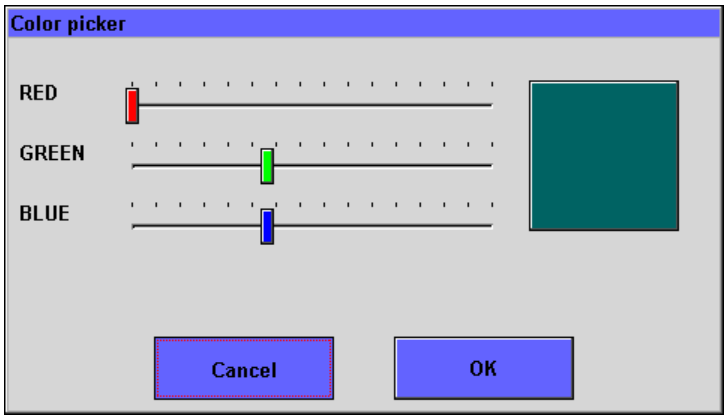


Figure 3-9: Displays how to specify the color of each pen

- **Name:** This parameter specifies the name of each font, which is usually the same as the name of the signal in the industrial process. The device accepts 10 characters for the name.
- **Unit:** This parameter specifies the unit of each font, such as Kg / hour or M3 / min. The number of characters is acceptable for a unit of 10.
- **Max and Min:** These parameters limit the variation of each font when drawing a graph or displaying a bar graph.
- HH H, L , and LL: These parameters specify the range of alarms for each pen :

(HH3, HH2, HH1), (H3, H2, H1), (L3, L2, L1), (LL3, LL2, LL1)

They are available for each item (See alarms section for more details).

2. Pen equation tab

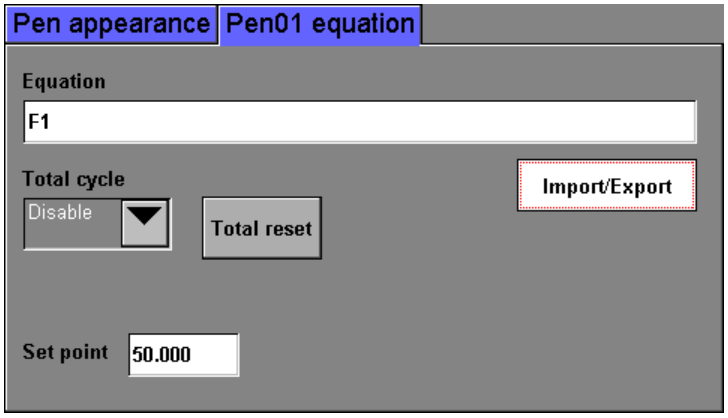


Figure 3-10: Pen equation tab

- **Equation:** This parameter is defined by the equation that defines the pen. This equation is defined by various mathematical functions based on various variables and constant numbers.

Note: When defining the equation of a pen, you can use the previous value obtained from the same formula. For example, if the P1 + 1 equation is used for P1, P1 will increase the value of one unit for each period of computation.

Import/ Export: To transfer this formula to another device, by pressing the Import / Export button the formula text stored in the txt file is stored on the USB flash memory. This button is also used to use equations that are located on another device or using a computer to transfer to a device in a file with a txt suffix.

Note: The maximum number of characters for this equation is 100.

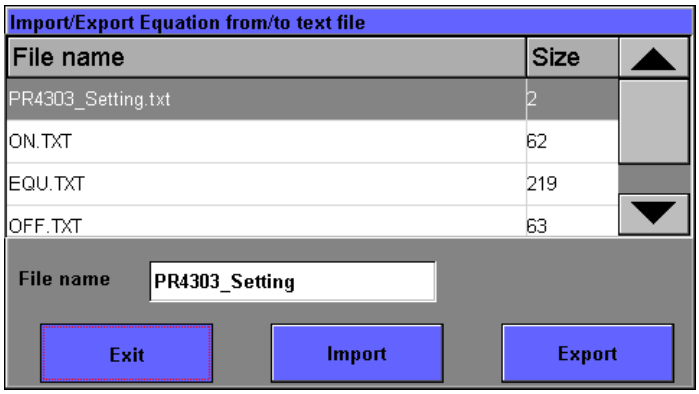


Figure 3-11: Import/ Export in Pen equation tab

To set the pen's time cycle, from the menu, these items (Sec, Minute, and Hour) can be selected. (This option is more useful when the recorder is used as a flow computer.)

Note: If the value of this parameter is Disable, it will not be displayed on the Total page.

- **Total reset:** This parameter is used to zero the total value of the totalizer (counting from the beginning).
- **Set point:** This parameter specifies the set point value for the PID controller.

Note: The outputs of this section will be available with the names P1, P2, and P3.

Note: To make changes before leaving, you must press the OK button.

Analog output:

In this section, the settings for the analog output channel are available. Analog output is based on mA. Also, by using the PID block, you can use these outputs to control a process.

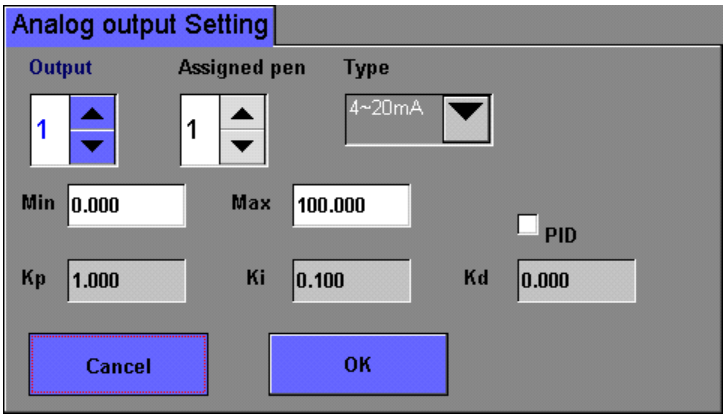


Figure 3-12: Analog output without PID controller

- **Output:** The output is selectable. As soon as the output is selected, its information will be displayed. There is a current output on this device.
- **Assigned pen:** There is a current output on this device. The instantaneous value can be assigned to one of the device pens.
- **Type:** To determine the type of output mA (0 ~ 5 mA or 0 ~ 20 mA or 4 ~ 20 mA), this parameter is used.
- **Max, Min:** By these two parameters, the output range of the mA signal is set.

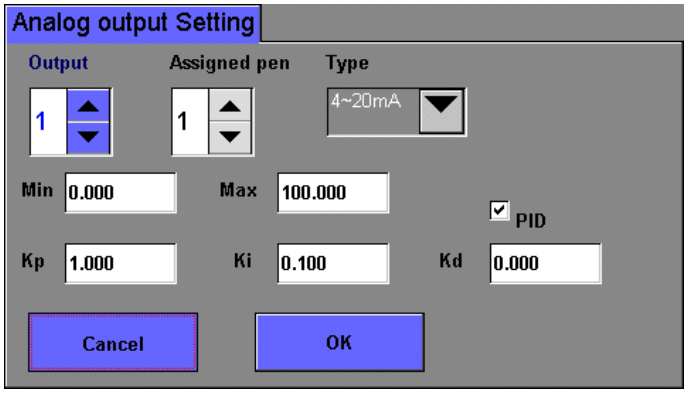


Figure 3-13: Analog output with PID controller

PID: If this parameter is activated, the analog output value is updated based on the PID calculations and according to the set point, Kp, Ki and Kd parameters, and the current value of the selected pen. The Kp, Ki, and Kd values should be set up according to the process under control.

Note: The output of this section, called O1, will be available.

Note: To make changes before leaving, you must press the OK button.

Relay:

In this section, the settings for switching the digital output (relay) on and off can be done.

- **Relay:** The relay is selectable. As soon as the relay is selected, its data will be displayed. There are eight relays in this device.
- **On condition:** In this section, the condition for switching on the relay is indicated.
- **Off condition:** In this section, the condition for switching off the relay is indicated.

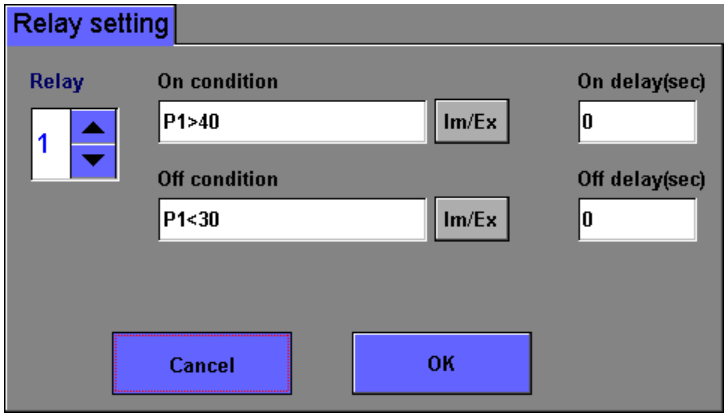


Figure 3-14: Relay

Note: The maximum number of characters for each of these equations is 100.

- **On delay:** After the relay on condition is established, the relay switching on timer starts counting, and if the timer reaches the On delay, the relay will turn on. If the condition of the On condition is not established, the switching on timer will be reset.
- **Off delay:** If the relay on condition was not established, the condition for switching off the relay is checked and if the condition is met, the relay switching off timer starts counting**.** If the timer reaches the Off delay, the relay will turn off. If the condition of the Off condition is not established, the shutdown timer resets.
- **Import/ Export:** To transfer this formula to another device by pressing the Import / Export button, the formula text that is selected in the txt file is stored on the USB flash memory This button is also used to use equations that are located on another device or using a computer to transfer to a device in a file with the txt suffix.

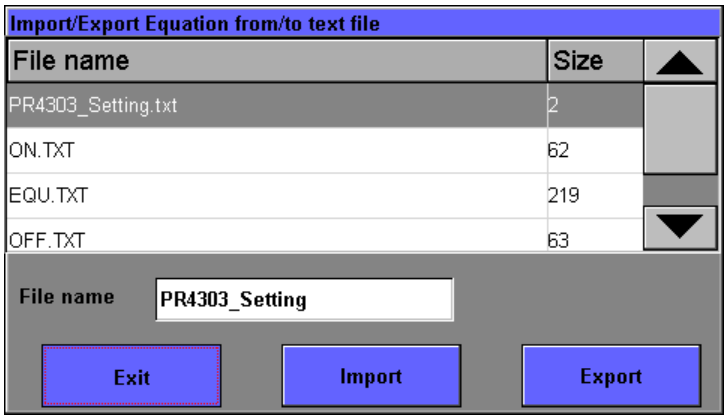


Figure 3-15: Import/ Export in Relay tab

Note: To make changes before leaving, you must press the OK button.

Group:

In this section, the settings for the device groups can be performed.

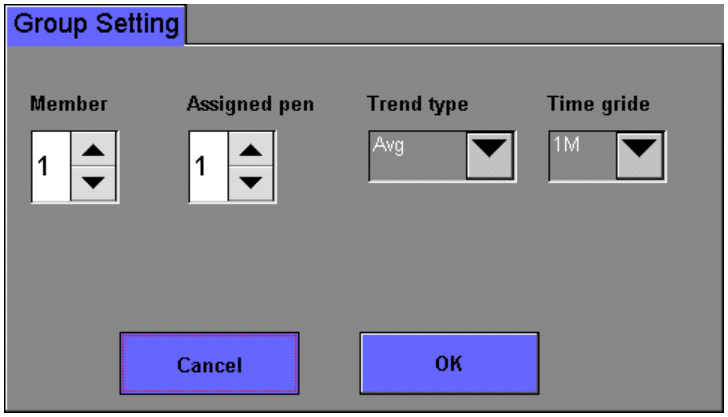


Figure 3-16: Group

Member: In this section the members of the group are identified. It can be assigned from one to three groups.

Note: If the pen corresponding to each member is set to zero, it will delete from the screens.

Assigned pen: In this section, we assign a number from 1 to 3 for each pen. If the number corresponding to each member is equal to zero, the pen of that member of the page will be deleted.

Trend type: This parameter is used to set the type of the points for the graphs. For example, if the Time grid is greater than 1min, because the number of samples taken is greater than the number of points that can be displayed in the graph, the system will draw the next point on the graph based on the value selected for this parameter. (Min samples obtained after the last spot drawn, Max Samples obtained after the last point drawn, Average Samples obtained after the last point drawn, Sample of the last sample, among the samples obtained from the last point that has been plotted).

Time grid: The distance of each grid of the axis of time in graphs is determined by using this parameter.

Different graph speeds and time interval data display:

Time grid	Duration of displaying data in online history
6 sec	2.5h
30sec	12h
1min	24h
2min	48h
5min	5day
15min	15day
30min	30day
1h	2month
3h	6month
4h	8month
6h	12month
12h	24month

Note: To apply the changes before leaving, you must press the OK button.

Clear graph:

By pressing this button, the curves on the graph display pages are cleared and begin to draw the graph from now on.

RTC:

This section is used to set the system clock.

- **Year:** In order to set the year of the system, enter the current year in Year section.
- **Month:** In order to set the month of the system, enter the current month in Month section.

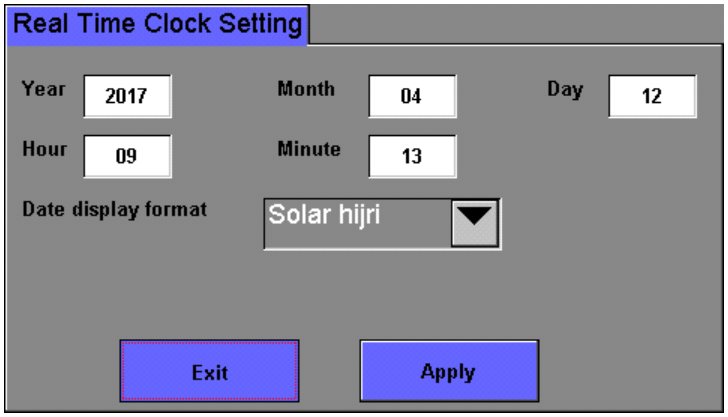


Figure 3-17: RTC section

- **Day:** In order to set the day of the system, enter the current day in Day section.

  Note: The date entered must be of the AD type.

- **Hour:** in order to set the hour of the system, enter the current hour in Hour section.
- **Minute:** In order to set the minute of the system, enter the current minute in Minute section.
- **Date display format:** To set the type of system date display, the date display format of the type you want (Gregorian and Solar hijri as a solar display) can be selected.
- **Note:** To apply the changes before leaving, you must press the Apply button.

Back light:

This section is used to adjust the brightness of the LED screen when the screen is active and the page activation time.

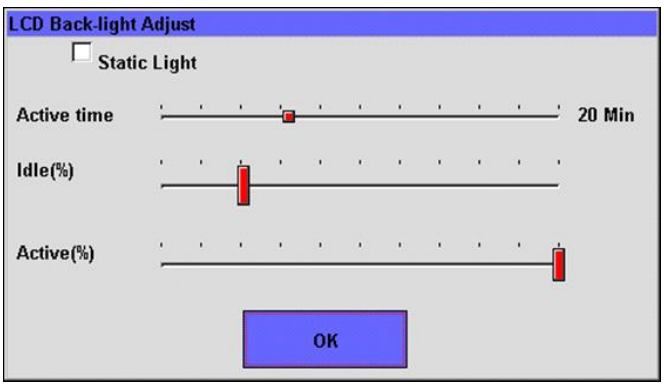


Figure 3-18: Adjust the light of the LED screen in the Backlight without activating Static light

- **Active time:** The amount of time that the screen is displayed after the last touch is set by this parameter.
- **Idle:** The brightness level of the display when it is inactive is performed by this parameter.
- **Active:** The brightness level of the display when it is active is performed by this parameter.

Note: If the static light option is ticked, as shown in Figure 3-18, the display will always remain active, and the two Active Time and Idle options will be disabled and only the page brightness level can be adjusted for the user.

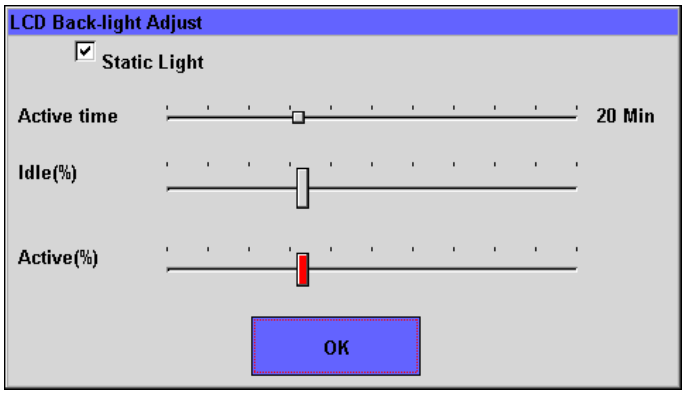


Figure 3-19

Note: To make changes before leaving, you must press the OK button.

Preferences:

In this section, the settings for the device name, pen, display screen, background color of the graph pages and the type of predefined indicator are selected.

- **Name:** The name of the device is adjustable here. This name is used in network applications and the naming of hard-copy, backup, and restoration files. The device does not accept more than 12 characters for the machine name.

- **Default pen:** The default function is to display the selected pen data in the Total counter and Single indicator.

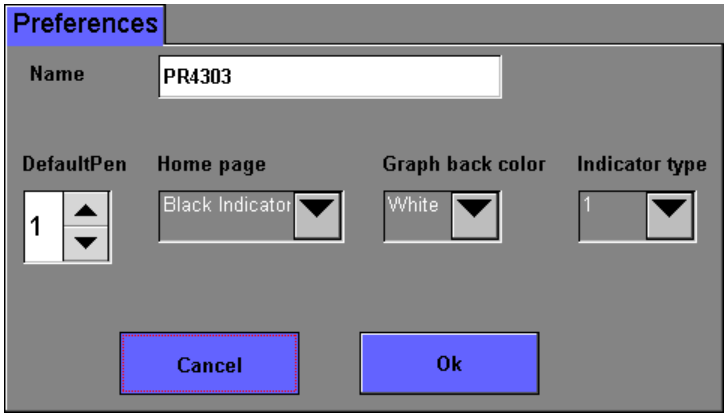


Figure 3-20: Preferences

- **Pen:** In this section, one of the Pens is selected from 1 to 3.
- **Home page:** This screen is displayed first when the system is turned on.
- **Graph back color:** You can use either black or white to adjust the background color of the graphs.
- **Indicator type:** This parameter specifies the number of pens available on the Black indicator page, which can be displayed between 1 and 3 pens on this page.

Note: To apply the changes before leaving, you must press the Apply button.

Communication:

In this section, the communication protocol, speed, parity, stop beat for the RS485 serial port is adjustable.

In the address section, the device address is set in the MODBUS network.

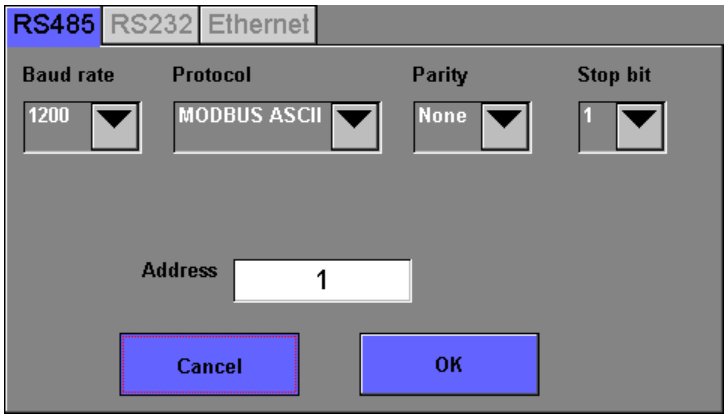


Figure 3-21: Communication

Note: To make changes before leaving, you must press the OK button.

Backup/ Restore:
This option is used to save and restore device settings data.

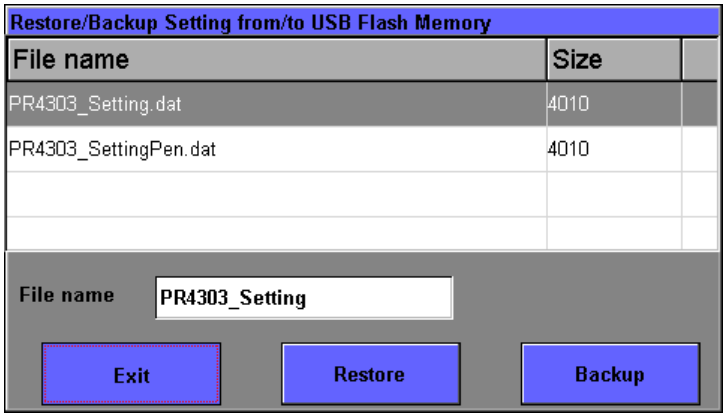


Figure 3-22: Backup/ Restore

To save the device data, you can choose from the list of files displayed on one of the files in USB, or create a new file (by entering the filename in the File name field) and by pressing the button, backup stores data in the file.

To retrieve device settings data from the list of displayed files, select the file you want and press the Restore button. All parameters of the device's settings are initialized with this.

Note: This save and restore is appropriate for copying device settings and using settings for another device.

Factory setting:

This option is used to return the device's settings to the initial settings.

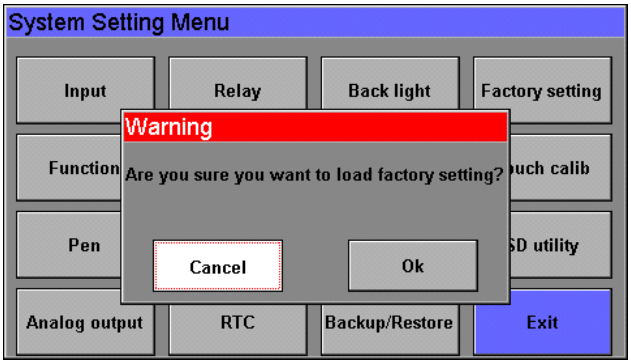


Figure 3-23: Factory Setting

Touch Calib:

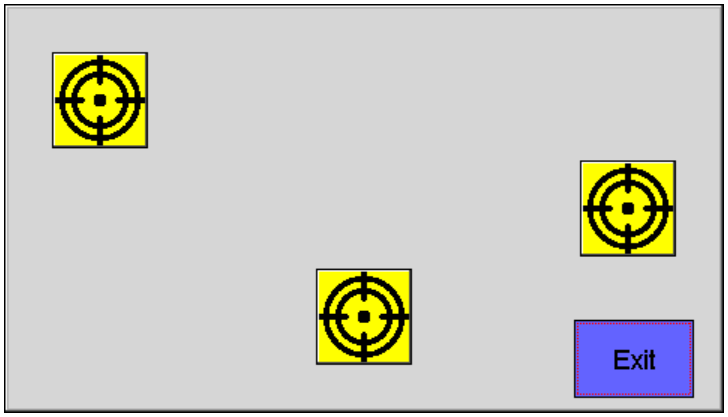


Figure 3-24: Touch calib screen to calibrate the device

This parameter is used to set the touch screen.

Whenever the user feels that the screen needs to adjust the touch, this page is used. The center of the three points displayed should be touched with an appropriate viewing angle and then removed from this page.

SD utility:

The user can use this in order to manage the SD memory of the device.

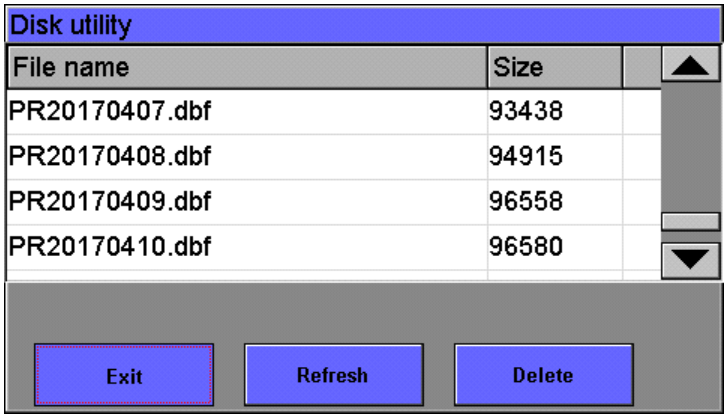


Figure 3-25: SD utility for memory management

If necessary, you can select unused files, then clear them by pressing Delete button.

Windows

Event menu:

This menu allows you to observe events and respond to relays.

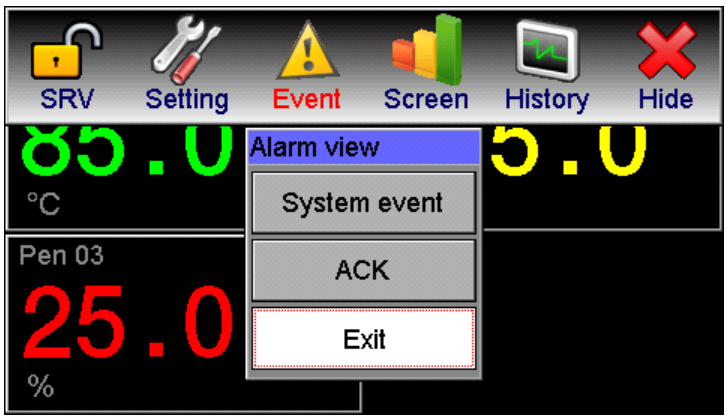
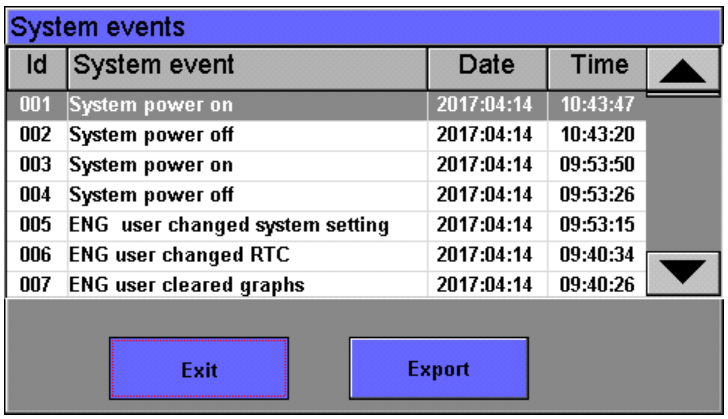


Figure 4-1: Event menu

System event:

This menu is used to view events occurring in the system. These events include all the changes the user has set in the device's settings, turning the power on and off.

Figure 4-2: System event



- **ACK:** To eliminate alarms, this section is used.

Screen menu: In this section, the pen data available on the device can be displayed in various ways like graph, bar graph and digital graph.

Inside the user's menu, the user enters to the Screen section and, depending on the need, he/she can choose from one of the 12 display screens to display data.

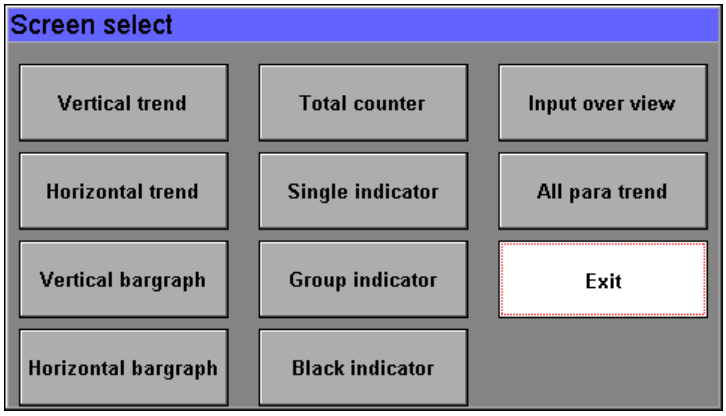


Figure 4-3: Screen menu

Note: In order to access the device Screen menu, the user needs to log in at least at operator level to enable this.

- **Vertical trend:**

In this section, the user can observe values from one to three items on the device in numerical form with its unit and displaying the alarms (if any) as well as in the vertical graph.

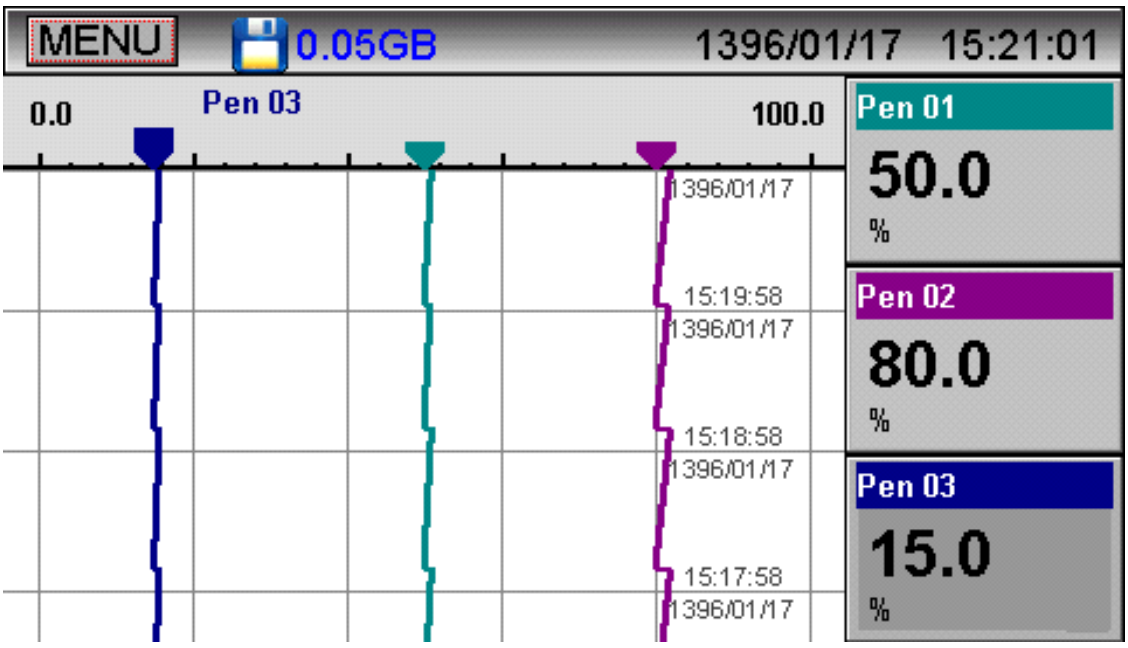


Figure 4-4: Displays the amount of fonts contained in the device numerically with the unit in the Vertical trend

Note: If there are alarms on each pen, the color of the bar changes based on the status of the existing alarms.

If the instantaneous value of a pen is between L (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a font is greater than H or L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

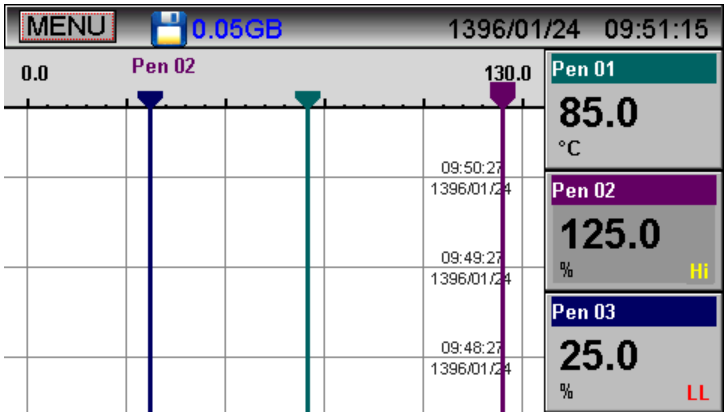


Figure 4-5: Alarms on the font in the Vertical trend page

On this screen once in every ... second, the name and the range of the pen that it is its turn is displayed at the top of the graph page where the graph is plotted.

Note: If necessary, the user can touch the font related to the name of the pen in any of the numerical fields to prevent it from drawing a graph.

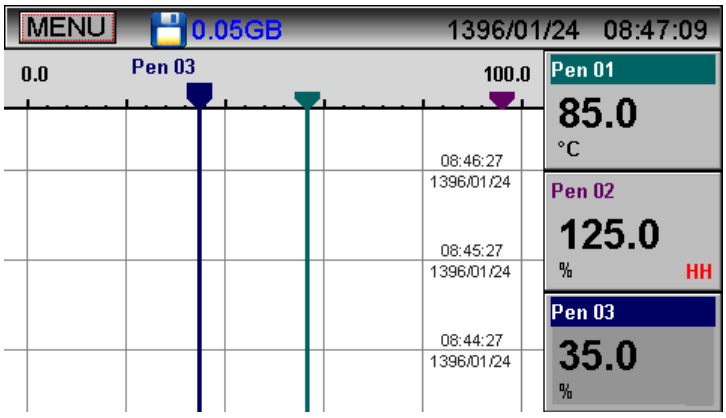


Figure 4-6: Remove a pen from the screen by touching the framework corresponding to that pen

Note: If in the group settings section, the attribute corresponding to each member is selected with zero, this item will be deleted from the screen.

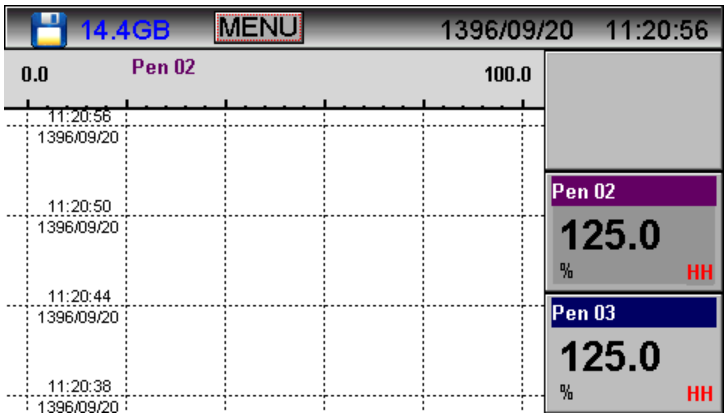


Figure 4-7: Delete the pen through the group settings

- **Horizontal trend:** In this section, the user can observe one to twelve pens in the device numerically with its unit and display the alarms (if any) and also in the form of a vertical graph.

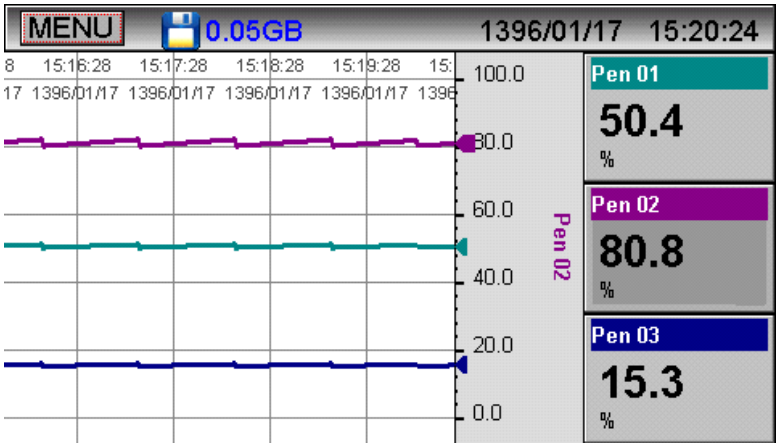


Figure 4-8: Displays the amount of fonts in the device numerically with the unit in the Horizontal trend

On this screen, once per second the turn is given to a pen which its graph is drawing. In this case, the background of that pen is darkened. The name of the pen and its range are written in the upper part of the diagram page.

Note: If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

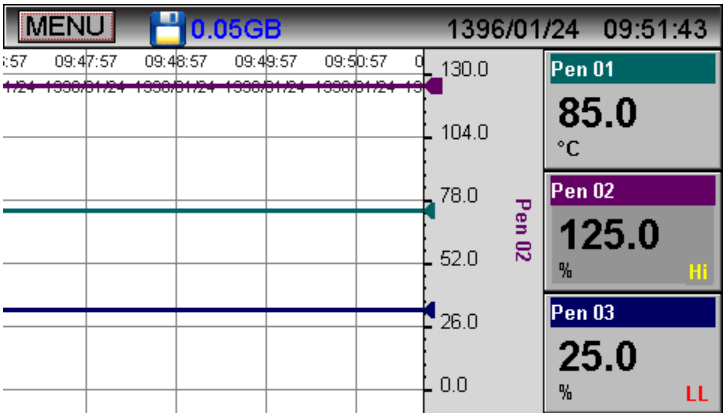


Figure 9-4: Alarm display in the Horizontal trend

Note: If needed, the user can touch the cadre corresponding to the pen name in each of the numerical fields to prevent the drawing of the graph.

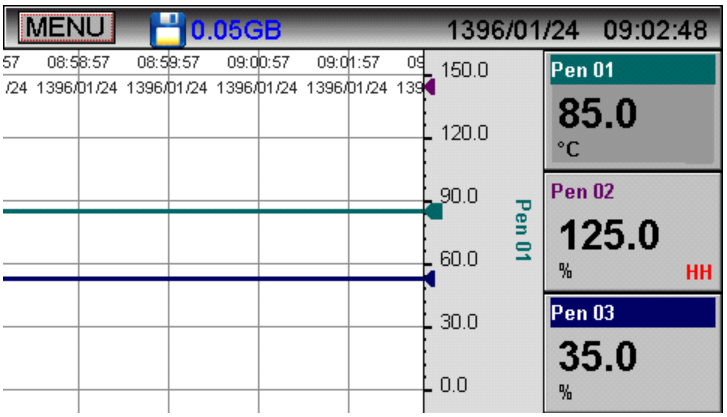


Figure 4-10: Touching the cadre related to one of the pens prevents the chart from being drawn

If in the group settings the pen corresponding to each member is zero, this pen is removed from the screen.

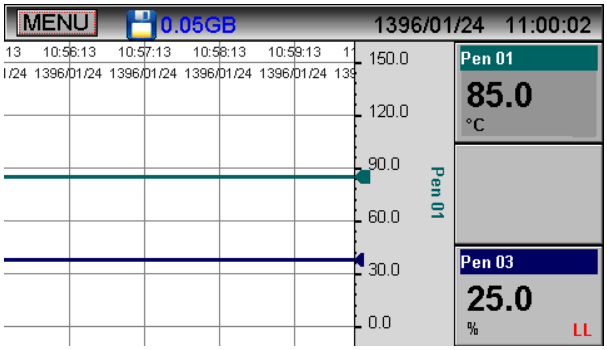


Figure 4-11: Removing a pen from the screen because of a pen with a value of zero corresponding to that member

- **Vertical bar graph:**

In this section, the user can observe one to twelve pens in the device numerically with its unit and display the alarms (if any) and also in the form of a vertical bar graph.

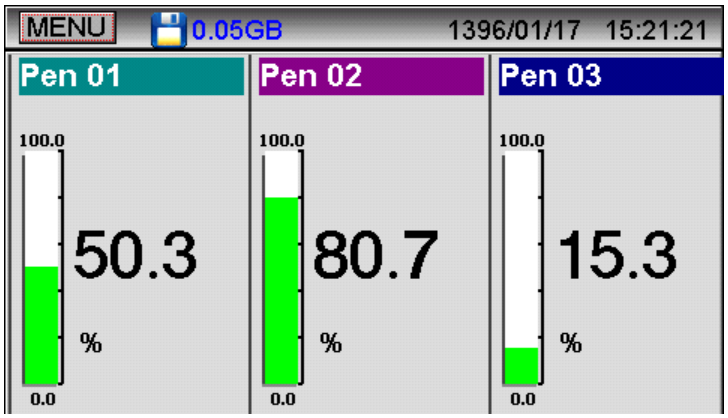


Figure 12-4: Displays the amount of pens contained in the device in numerical order with the unit in the Vertical bar graph

Note: If there are alarms on each pen, the color of the bar graph changes according to the status of the existing alarms.

If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

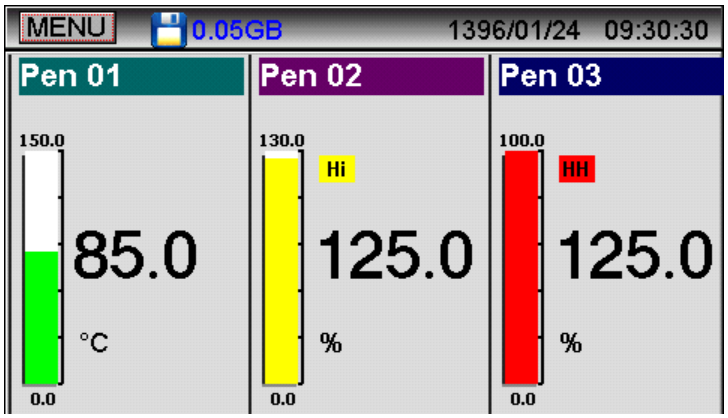


Figure 4-13: Existence of alarm on pen

If in the group settings the pen corresponding to each member is zero, this pen is removed from the screen.

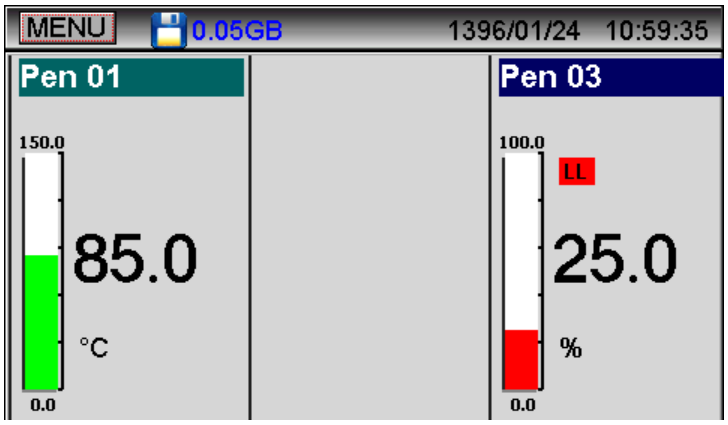


Figure 4-14: Zeroing the corresponding pen with two members and removing the two items from the page in the Vertical bar graph section.

- **Horizontal bar graph:**

In this section, the user can observe one to twelve pens in the device numerically with its unit and display the alarms (if any) and also in the form of a horizontal bar graph.

Note: If there are alarms on each pen, the color of the bar graph changes according to the status of the existing alarms.

If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

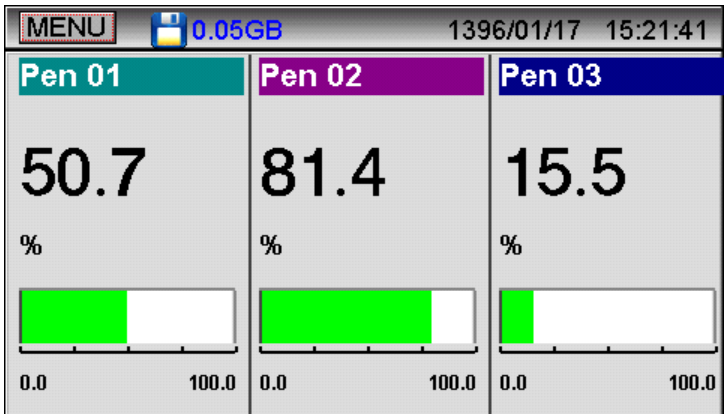


Figure 4-15: Horizontal bar graph

The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

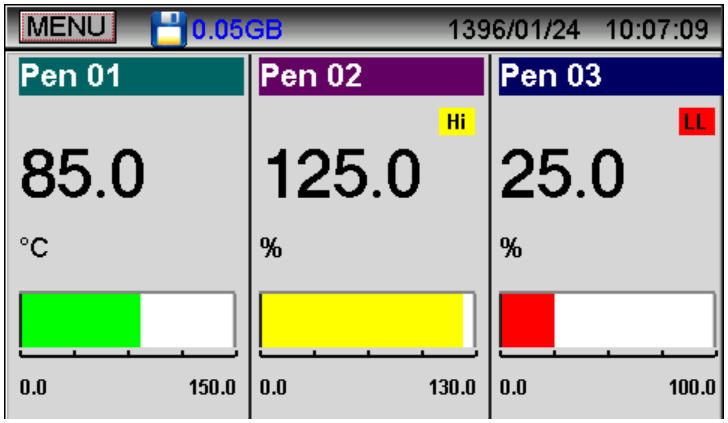


Figure 4-16: Existence of alarm on pen

If in the group settings the pen corresponding to each member is zero, this pen is removed from the screen.

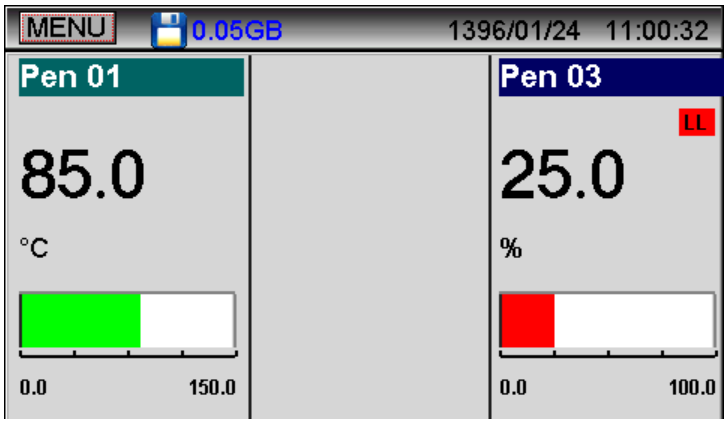


Figure 4-17: Zeroing the corresponding pen with two members and removing the two items from the page in the Horizontal bar graph section.

- **Total counter:**

In this section, the user can see the cumulative amount of the default pen (the pen selected in the preference page) along with its instantaneous value, its unit and alarms (if any).

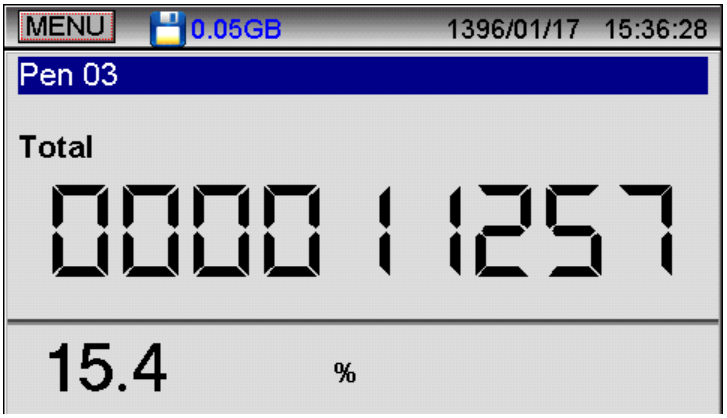


Figure 4-18: Total counter

Note: If the default value for the Total cycle parameter is Disable in the pen settings section, the page does not display a cumulative value (Total number).

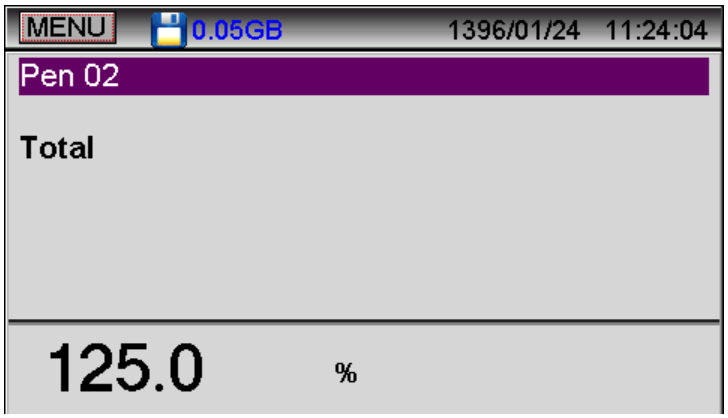


Figure 19-4: Total counter display when Total cycle parameter value is Disable.

- **Single** indicator:

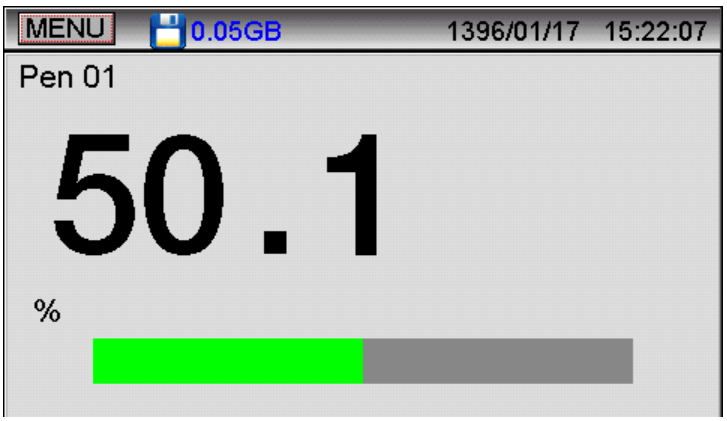


Figure 4-20: Displays the green color to indicate the absence of alarms

In this section, the user can see the instantaneous amount of the default pen (the pen selected in the preference page) along with the graph, its unit and alarms (if any).

Note: If there are alarms on each pen, the color of the bar changes according to the status of the existing alarms.

If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a font is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

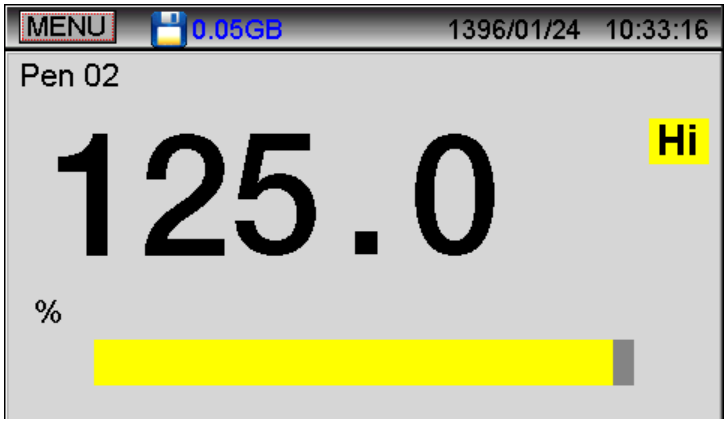


Figure 4-21: Displays the yellow color of the warning sign when the amount of the pen exceeds the value of Hi

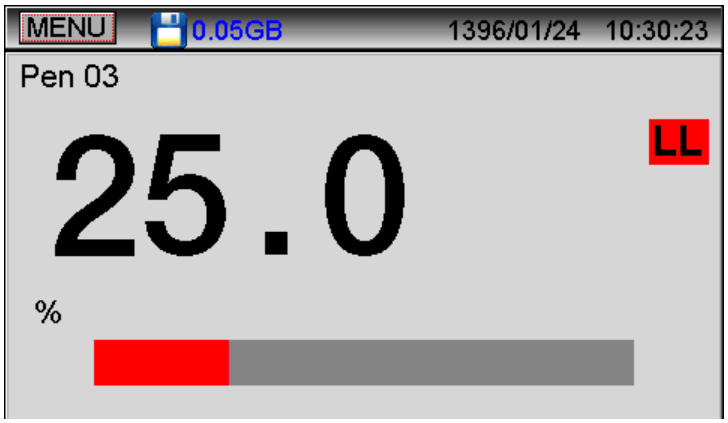


Figure 4-22: Displays the red color as an alert when the amount of the pen exceeds the HH value

- **Group indicator:**

In this section, the user can see the amount of the pens assigned to the group members in the Group menu in the Setting menu, along with its unit and alarms (if any).

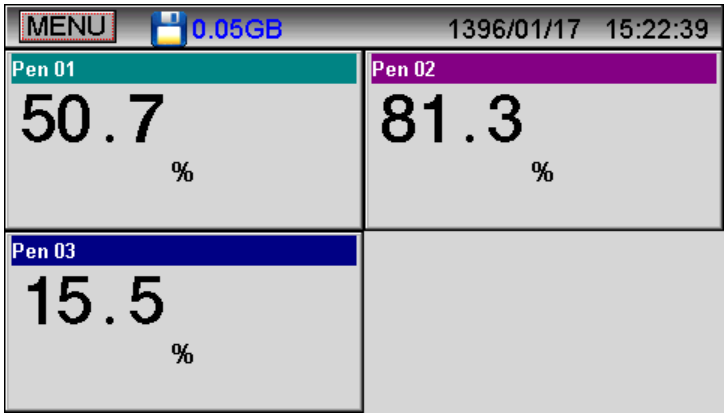


Figure 4-23: Group indicator

Note: If there is an alert for each pen, the color of the bar graph changes according to the status of the alarms.

If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

If in the group settings the pen corresponding to each member is zero, this pen is removed from the screen.

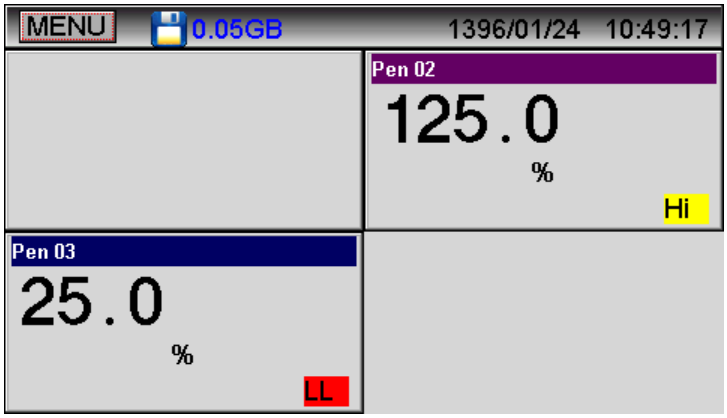


Figure 4-24: Zeroing the corresponding pen with two members and removing the two items from the page in the Group indicator section.

- Black indicator:

In this section, the user can see the instantaneous value of the pens along with the units and alarms (if any).

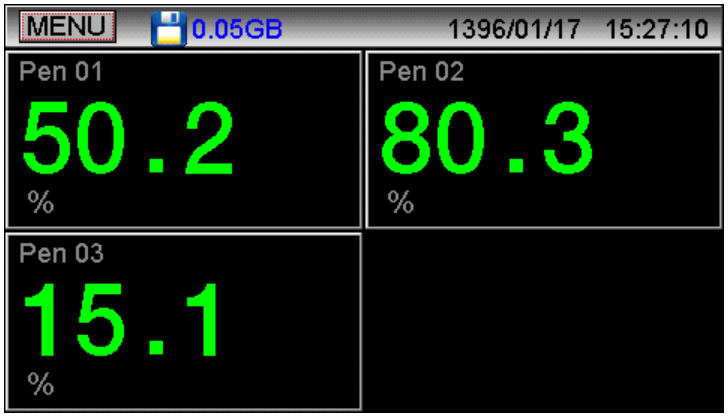


Figure 4-25: Black indicator

Note: If there is an alert for each pen, the color of the bar graph changes according to the status of the alarms.

If the instantaneous value of a pen is between l (LOW) and H (HIGH), that pen has no alarms and is in normal condition.

The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state.

The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status. (For more information, see Alarms section).

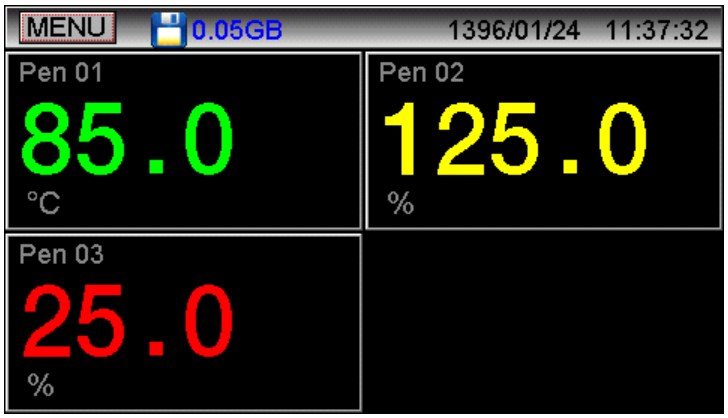


Figure 4-26: Change font color according to the status of the existing alarms

Note: In the Preferences section, in the Indicator Type dropdown menu, the number of pens that can be displayed on this screen is selectable from one to three pens.

If in the group settings the pen corresponding to each member is zero, this pen is removed from the screen.

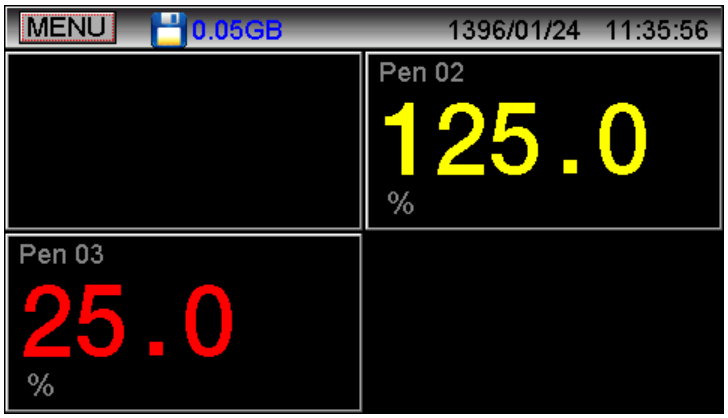


Figure 4-27: Zeroing the corresponding pen with two members and removing the two items from the page in the Black indicator section.

- **Input overview:**

To view the instantaneous values of the electrical parameter of each input device, this page is used.

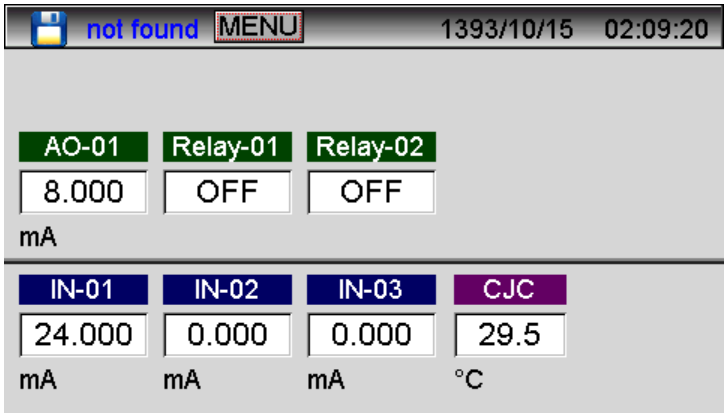


Figure 4-28: View the instantaneous values of the electrical parameter of each device input in the Input overview section.

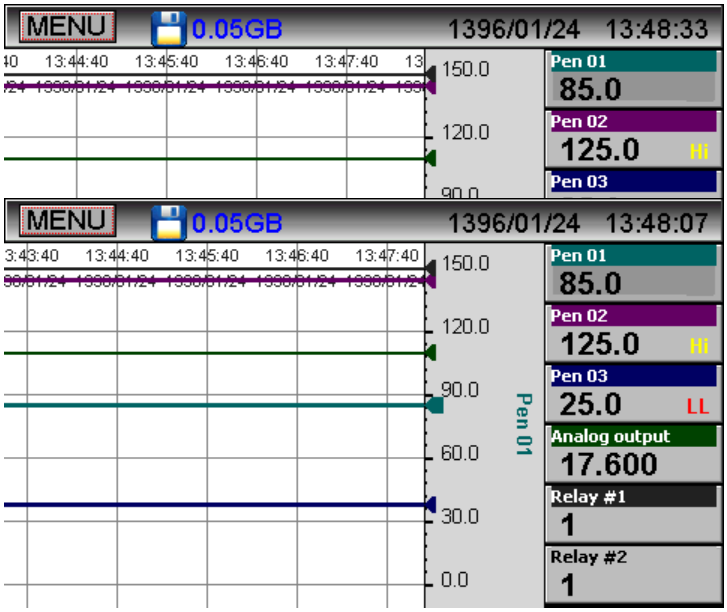
The number is shown and its unit is proportional to the input type. For example, if the type of input is thermocouple or thermos resistance, the value displayed is mV. Or, if the input type is 4 ~ 20 mA, the value displayed is mA.

The CJC value shown on this page is equal to the temperature read by the temperature sensor mounted on the card. The upper row also shows the amount of current output and the status of the two relays. You can also use this page to calibrate the device as explained in the calibration section.

- **All para trend:**

On this page, the values of three pen, an analog output and two relays are visible.

Figure 4-29: All para trend page



Note: If needed, the user can stop drawing the chart by touching the cadre corresponding to the name of the pen, the analog output, and the relays in each of the numerical fields.

Figure 4-30: All para trend page with alarms

- **History menu:**

This menu is used to view the status of each pen in the past. In this section, the data is loaded from the archive section on the page. This device has data storage capability, depending on memory capacity for at least 5 years. To view the data in the History of the device, in the Online History section, data can be viewed online since the device was turned on, depending on the time grid setting from several hours to several months ago. There is also all data for at least 5 years in the archive, which can be accessed by visiting the History of the device in the Archive section, and can view the date and view the data of that day, as well as extract the Excel file on the flash.

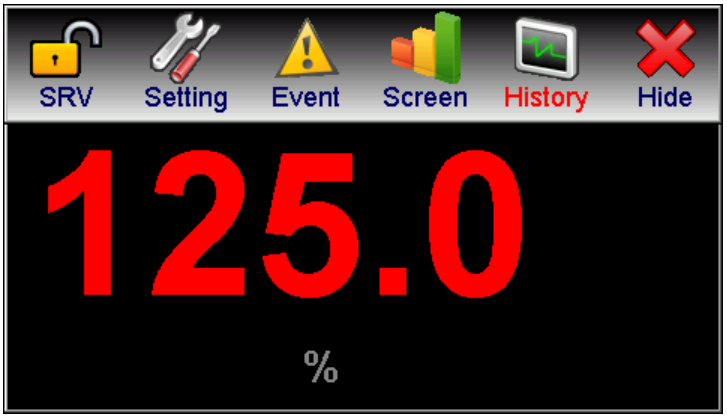


Figure 4-31: History menu

- **Export:**

This option is used to transfer data about a graph of a time period that depends on the Time grid in the Group Setting group.

This data is stored on the USB flash drive, called the device name as an Excel file. The file can easily be analyzed in an Excel environment.

Figure 4-32: Export option in History menu

- **Archive:**

The data of a specific day in the archive is visible in this section by entering data about that day.

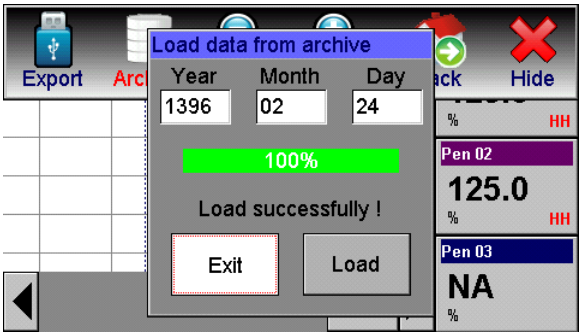


Figure 4-32: Archive option in History menu

- **Zoom+ and Zoom- :**

These two options are used to zoom in and zoom out.

Note: To save specific time data, first go to the Archive section and enter the date for the data we have, and then select the Load option. Subsequently, the Export section of the history entry is saved as an Excel file and will be easily accessible.

Attachment 1

Formulating:

Formulating is one of the most important features of this device, which makes it possible to do a variety of tasks by this device. Further, the formulation and the writing of conditional sentences are described with some examples.

The list of available functions is as follows:

$Pow(x,n)$	Computes the amount of x^n.
$Mod(x,y)$	Returns the remainder of x by dividing y.
$Sqrt(x)$	Returns the second root x.
$Cbrt(x)$	Returns the third root of x.
$Log2(x)$	Calculates the logarithm of second root of x.
$Log(x)$	Calculates the logarithm of tenth root of x.
$Ln(x)$	Calculates the logarithm of the np x base.
$Exp(x)$	Calculates the value of np to x.
$Exp2(x)$	Calculates the value of 2 to x.
$Sin(x)$	Calculates the value of sin *x* (*x* in radians).
$cos(x)$	Calculates the value of cos *x* (*x* in radians).
$Tan(x)$	Calculates the value of the tangent *x*(*x* in radians).
$Asin(x)$	Calculates the Arc sin value of the *x* variable (*x* in radians).
$Acos(x)$	Calculates the Arc cos value of the *x* variable (*x* in radians).
$Atan(x)$	Calculates the Arc tan value of the *x* variable (*x* in radians).
$Atan2(x)$	Calculates the arc tan value of the *x* variable (Only the main angle is calculated).
$Abs(x)$	Calculates the absolute value of *x* (The answer is a integer number).
$abs(x)$	Calculates the absolute value of *x* (The answer is a decimal number).

$Floor(x)$	Calculates the value of the *x* bracket.
$Round(x)$	Round the amount of *x*.
$Min(X1, X2, \ldots., X10)$	Returns the minimum of the input parameters (This function has a maximum of 10 inputs).
$Max(x1, X2, \ldots\ldots, X10)$	Returns the maximum of the input parameters (This function has a maximum of 10 parameters).
$Avg(X1, X2, \ldots., X10)$	Returns the average of the input parameters (This function has a maximum of 10 inputs).

Variables:

To access input values (read) and device output; some variables are considered. The list of these variables is as follows:

Ta	The ambient temperature is accessible by this variable.
Sec	The instantaneous value of seconds in the system's clock is accessible by this variable.
$Minute$	Holds the instantaneous value of minute in the system's clock.
$Hour$	The instantaneous value of hour in system's clock is accessible by this variable.
Day	The number of day from the current date is accessible by this variable.
$Month$	The number of month from the current date is accessible by this variable.
$Year$	The number of year from the current date is accessible by this variable.
$I1, \ldots, I12$	Except the amount received from thermocouple sensors and thermo-resistant, the numerical value measured from the desired channel (channels one to three) is determined by the linear equation defined by the min and max parameters to the new value of the scale.
$P1, P2, P3$	The values obtained from the equations of each pen, inside this variables are available.
$O1$	The current value holds the output of current 1. (Flow output is in milliamp and based on decimal form).
$1, R2$	Controls the on or off relay outputs status (If it is on, it has the value of 1 and if it is off, it is zero).
$HHx \quad (x = 1, \ldots, 12)$	Holds the maximum allowed amount of a pen.
$LLx \quad (x = 1, \ldots, 12)$	Holds the minimum allowed amount of a pen.
$Hx \quad (x = 1, \ldots, 12)$	Holds the maximum amount of a pen.
$Lx \quad (x = 1, \ldots, 12)$	Holds the minimum amount of a pen.

How to use functions and variables:

1	$I1$	Given the input configuration 1 as the flow input, the output follows the input current 1. (Like jumper the input 1 to output).
2	$log(I1 + I2/2)$	
3	$Avg(I1, I2, I3)$	Assuming three temperature sensors in three points of an environment and connecting them to inputs of one to three, the average environmental temperature is calculated.
4	$Min(I1, I2, I3)$	Assuming three pressure sensors are connected to one to three inputs, the minimum pressure sensor is displayed.
5	$I2/60$	By assuming the second input in the meter frequency mode an connecting it to the turbine's turret sensor, the frequency will be calculated by dividing the number of input pulses by 60.
6	$Avg(p1, I1)$	Assuming the temperature sensor is connected to the input number 1, it is created by a phrase opposite to a filter that prevents unwanted fluctuations.
7	$(I1 + I1\text{^}2 + I1\text{^}3 + I1\text{^}4)/(I1 + I1\text{^}2 + I1\text{^}3 +)I1\text{^}4 + I1\text{^}$	
8	$1/2.5 \times 1000$	Assuming the connection of a pressure transducer with a frequency output (one mill bar i equal to 2.5 Hz), the input of i1 calculates the equation of input pressure in terms of bar.
9	$Equation\ in\ pen2$: $exp((I2 * 4 * 8.31441)/(8.31 * (I1 + 273.16))$	An oxygen sensor in the smoke (Zirconium oxide) is connected to the input channel 2 And a thermocouple (which reads the core temperature of th sensor) is connected to Channel One. This equation, written in pen2, represents the output valu of the sensor.

It should be noted that these variables are read-only and you cannot write any amount in them.

Use control commands to command relays number one and two:

The list of commands you can use is as follows:

Operator	Usage
==	Evaluating the equivalence of the two variables
>	Checking out the Smaller
<	Checking out the bigger
>=	Comparing being larger or equal between two variables
<=	Checking out being smaller or equal
! =	Investigate the inequality of two values
&&	Check the validity of the two conditions simultaneously (the *and* operator)
||	Check the validity of one or both of the two conditions (the *OR* operator)
!	Reverse check result (*NOT* operator)

To control and place the condition for the on or off status of each of the relay outputs in the setting screen, enter the Relay menu. We consider the relay field equal to the relay we intend to control. In the on condition field, enter the condition or conditions that are activated when the relay is set up. And in the off condition field, we enter the condition or conditions that cause the relay to be deactivated.

1	$On\ condition:$ $i1 > 50$ $Off\ condition:$ $i1 < 40$	Assuming that the thermocouple is connected to input number 1, if the temperature is higher than 50 ° C, the relay is activated and the relay switches off if the temperature is lower than 40 ° C.
2	$On\ condition:$ $i1 > i2$ $Off\ condition:$ $i2 <= i1$	If the value of I1 is greater than I1, the relay is activated, otherwise it will be disabled.
3	$On\ condition:$ $(sec == 20)\&\&(min == 30)\&\&(hour == = 12)$ $Off\ condition:$	At 12:30:20, the relay turns on for 10 minutes and turns off after ten minutes.

	$(sec == 20)\&\&(min == 40)\&\&(hour == = 12)$	
4	$On\ condition:$ $i1 > 50 \mid\mid i2 > 10$ $Off\ condition:$ $i1 < 50 \&\& i2 < 10$	Assuming the thermocouple is connected to the input 1 and the pressure sensor to the input 2, if the temperature increased by 50 ° C or the temperature is 10 times greater, the relay is activated and if the input of number one is less than 50 and simultaneously input 2 is lower than 10, the relay will be disabled.
5	$On\ condition\ (Relay1):$ $avg(i1, i2) == 50 \&\& (R2 == 1)\&\&(!i3)$ $Off\ condition\ (Relay1):\ i3$	Assuming that the two RTDs are connected to inputs 1 and 2, the input configuration of number 3 as a digital output, if the average temperature of both sensors is 50 ° C and the relay number 2 is also active, the relay number 1 is activated. If the number 3 is activated, the relay number1 is deactivated.
6	$On\ condition\ (Relay1):$ $avg(i1, i2) == 50 \&\& (R2 == ON)\&\&(!i3$ $Off\ condition\ (Relay1):\ i3$	The previous example can also be written in this form.
7	$On\ condition:\ !R1$ $Off\ condition:\ R1$	The relay number one regularly switches on and off every second (0.5 Hz frequency).
8	$On\ condition:\ Ta >= 50$ $Off\ condition:\ Ta < 45$	If the ambient temperature is greater than 50 ° C, relay will activate and if the temperature is below 45, the relay will deactivated.
9	$On\ condition:$ $(i1 == 1) \mid\mid (i2 >= 3333) \mid\mid (i3 >= 3333$ $Off\ condition:$ $(i1! = 1) \&\&(i2 < 3333) \&\&(i3 < 3333)$	Assuming input configuration number 1 as digital input and inputs number two and three as inputs of frequency and connection of sensor turbine to inputs two and three, and circuit breaker connection to input number 1, with the turbine speed rising (in Each of the inputs of two and three) or the circuit breaker opens, the relay is activated.
10	$On\ condition:$ $(p1 > HH1) \mid\mid (p1 < LL1)$ $Off\ condition:$ $(p1 =< HH1) \&\& (p1 >= LL1)$	If the value of item 1 is greater than or less than the limit, the relay will be activated, and if the value of item 1is in the allowed range, the relay will turn off.
11	$On\ condition:$ $(Ta >= 50 \&\& i1 >= 40) \mid\mid (P1 >= HH1$ $Off\ condition:$ $(Ta < 45 \&\& i1 < 35) \&\& (P1 < HH1)$	If the ambient temperature is greater than 50 ° C and at the same time, the temperature reading from channel 1 is more than 40 ° C, the relay is activated. Also if the value of pen 1 is exceeds the maximum value, the relay will be activated. If all input values are lower than the permitted value, the relay will turn off.
12	$ON\ CONDITION\ (RELAY1):$ $R2 == OFF$ $OFF\ CONDITION\ (RELAY1):$ $R2 == ON$	In this case, the relay number 1 is in the opposite position with the relay number one.
13		In places where the device's input signals are received, signals from other devices (e.g.,

	$ON\ CONDITION\ (RELAY1):$ $P1 > 50\ \&\&\ TR >= 6$ $OFF\ CONDITION\ (RELAY1):$ $P1 < 45\ ||\ TR < 6$	isolators) are taken, and all of these devices may be powered or disconnected simultaneously. When the devices are turned on (or the power is interrupted) due to the fact that the time of stabilization of all the devices is not the same, a signal with some incorrect signal can be applied to the input at the moment of turning on the device and cause the false command To make. To avoid this problem, conditions that directly stimulate the quantities generated by other devices can depend on the duration of the system being switched on. In this case, you can consider the time in seconds as the process's sustainability time, so that no order is issued within this period. For example, consider the case where the input signal number 1 of this device is connected to an isolator and converted to a temperature degree by pen (PEN) number one. Supply of the isolator and PR5608 are also provided at a common source. If the power is interrupted, due to a 6-second delay in checking the temperature rise condition, the possibility of an error alarm will be lost.

Attachment 2

Inputs calibration:

In case of calibration of each device input, the following conditions must be met:

1- Turn on the device and have Warm Up time. (About 15 minutes)
2- Login to the device at the service level.

Part1: This part includes calibration of the input offset value. To do this, it is necessary to have a short circuit in pin 1 and 2 to the input, so that the input value of zero is applied to the desired input. Then enter the Input overview in the screen menu and the page will open as shown in Figure A.2. Then, by touching the numerical area of the desired channel, the analogue input calibration is opened in accordance with Fig B.2. Then you need to touch the button offset. If this is the case, then the offset value is calibrated.

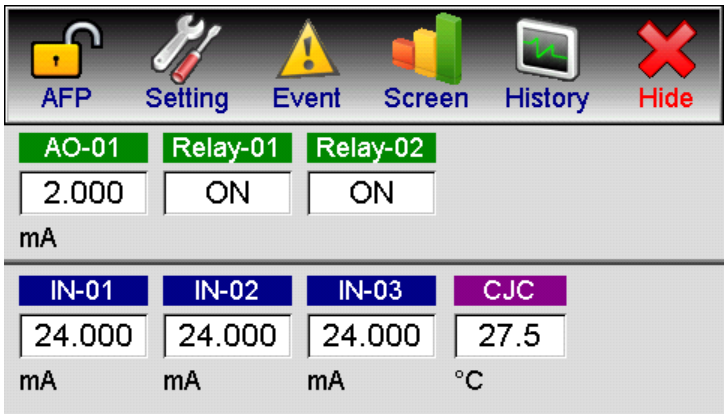


Figure A.2: Input overview page

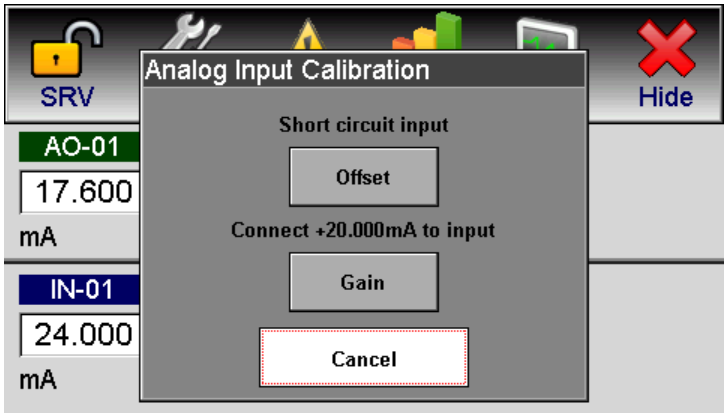


Figure B.2: Analog input calibration window

- Offset calibration is done for all inputs in this way.
- After the calibration operation, the input signal value must be zero.

Note: In the case of thermo resistance or PT100, there is no need to calibrate Offset.

Part 2: Calibration of the input Gain value is required:

For calibration mV, the exact value is 50.000 millivolts. For calibration -1 ~ 1 V and 0 ~ 1 V, the exact value is 1.000. For calibration of voltages more than 5V, the exact value is 5.000. For calibration of the mA measurement the accurate value is 20,000 mA. And for thermo-resistance calibration, the 100 Ohm accurate resistance is connected to the desired input.

Then, by touching the numerical area of the desired channel, the calibration window opens; then you need to touch the Gain button; after that, if the above items are met, the Gain value is calibrated.

Note: The calibration order for each input must be done as follows:

1- *Gain offset* calibration, input type: mv
2- *Gain offset* calibration, input Type: 0 ~ 1V
3- *Gain offset* calibration, input type: 0 ~ 5V
4- *Gain offset* calibration, input type: 0 ~ 20 mA
5- *Gain offset* calibration, input type: Thermo resistance

Milliamp Output Calibration:

First, by touching the numerical area of the output on the Input overview page and opening the calibration window according to Fig C.2, enter the Gain value equal to 1 and touch the Calibrate button. Then connect a precision mA meter to the desired output and get the new output Gain through the following formula:

Gain= (The amount measured by the exact Ma meter / ideal value of the desired output)

Then enter the value obtained for Gain through the calibration page and touch the Calibrate key.

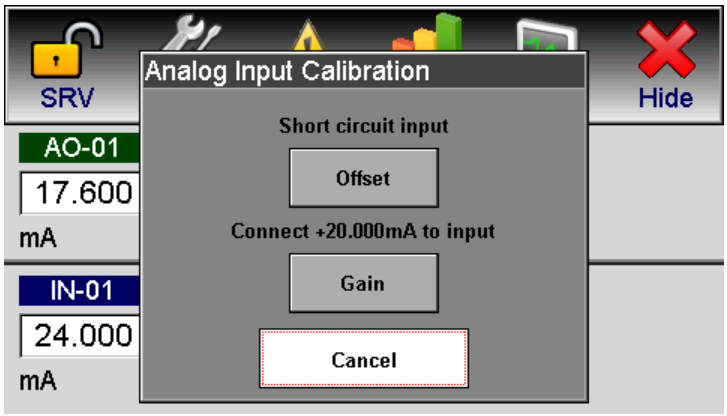


Figure C.2: Analog output calibration window

If all of the above steps are done correctly, the output will be calibrated.

Attachment 3

Alarms

• Where will we have yellow and red alarms in device?

In the SETTING menu, in the PEN submenu, for each item from 1 to 12, values are set to HH and H, LL and L. If the instantaneous value of a pen is between l (LOW) and h (HIGH), that pen has no alarms and is in normal condition. The yellow color indicates the status of the warning. If the value of a pen is greater than H or less than L, we will be in a warning state. The red color indicates the alarm status. If the value of a pen exceeds a greater amount of HH, or less than LL, we are in alert status.

How to display different types of alarms:

- In the Vertical trend submenu, if there are alarms on each of the pens (as shown in Figure A.3), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes in the numeric part of the pen with alarms.

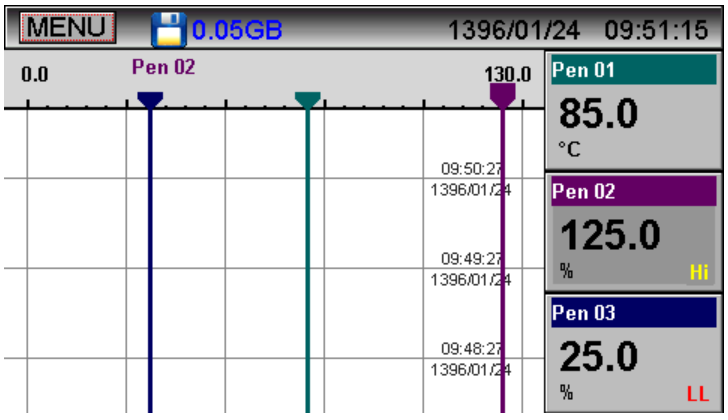


Figure 3.A: Displaying alarms in vertical trend

- In the Horizontal trend submenu, if there are alarms on each of the pens (as shown in Figure 3.B), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes in the numeric part of the pen with alarms.

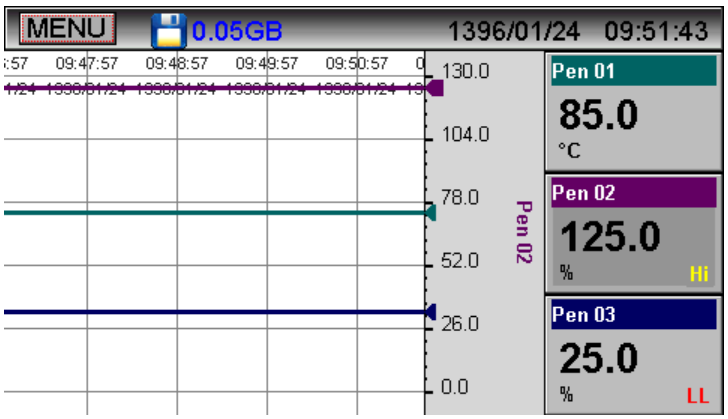


Figure 3.B: Displaying alarms in horizontal trend

- In the Vertical bar graph submenu, if there are alarms on each of the pens (as shown in Figure 3.C), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes in the numeric part of the pen with alarms.

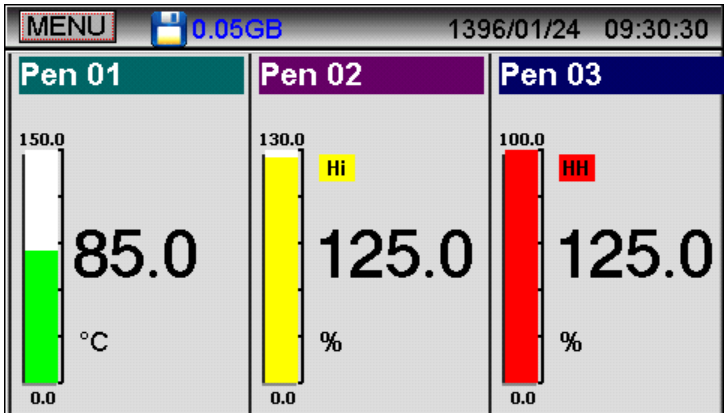


Figure 3.C: Displaying alarms in Vertical bar graph

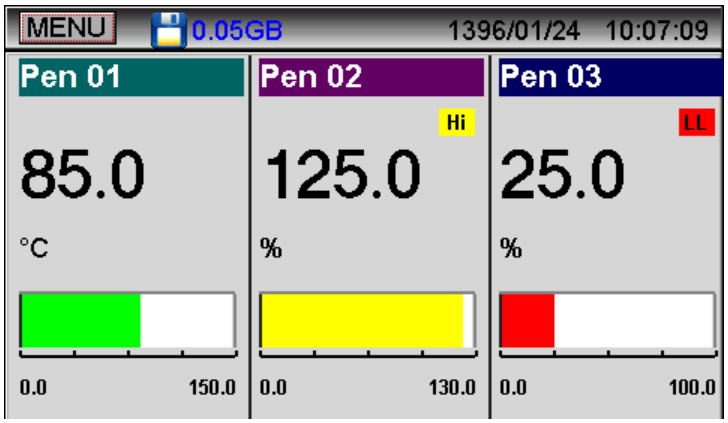


Figure 3.D: Displaying alarms in Horizontal bar graph

- In the Horizontal bar graph submenu, if there are alarms on each of the pens (as shown in Figure 3.D), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes at the end of the of the pen's bar graph with alarms.
- In the Vertical bar graph submenu, if there are alarms on each of the pens (as shown in Figure 3.E, 3.F, 3.G), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes at the end of the pen's bar graph with alarms. If there is a normal status, the color of the bar graph will be green.

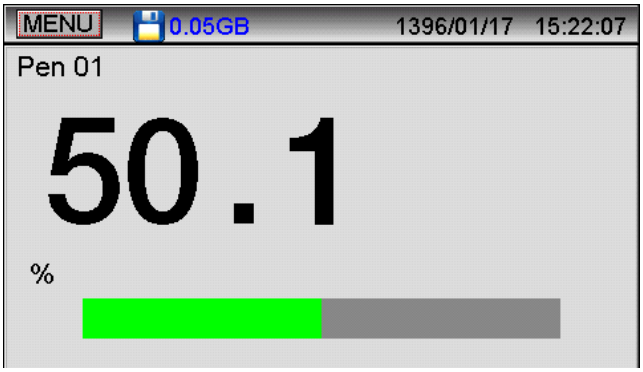


Figure 3.E: Absence of Alarms in Single Indicator

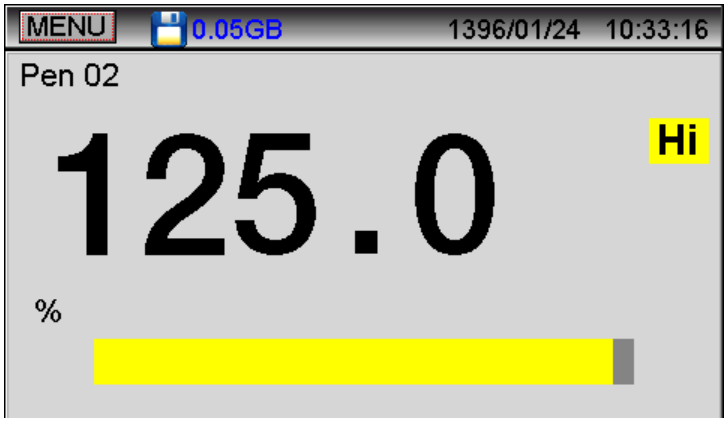


Figure 3.F: displaying alarm in Single Indicator

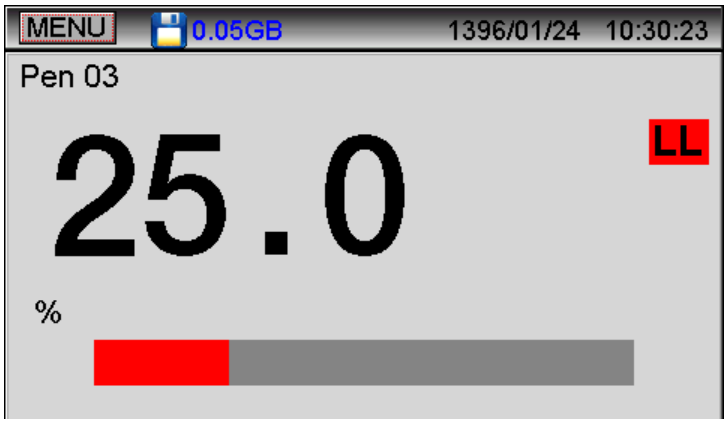


Figure 3.G: Displaying alarm in Single Indicator

- In the Group Indicator submenu, if there are alarms on each of the pens (as shown in Figure 3.H, 3.I), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes in the numeric part of the pen with alarms.

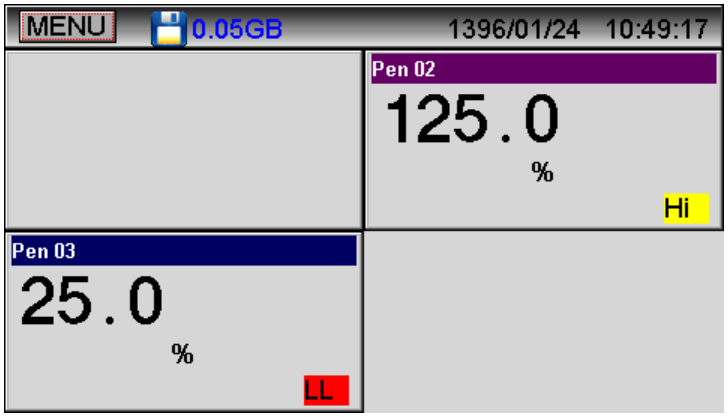


Figure 3.H: Displaying alarms in Group Indicator

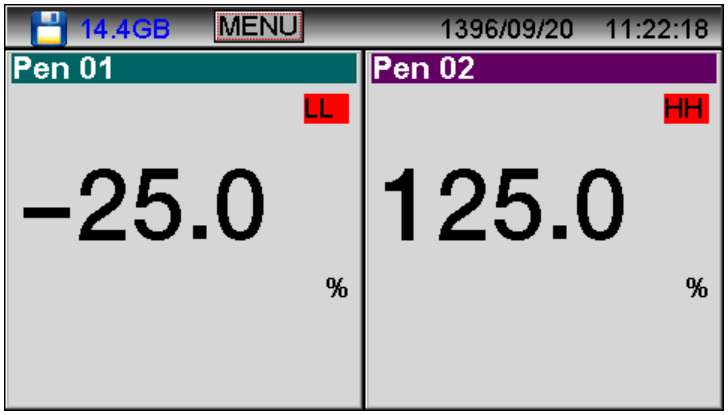


Figure 3.I: Displaying alarms in Group Indicator

- In the Black indicator submenu, if there is an alert on any of the pens (as shown in Figure 3.J), the alarms are displayed by changing the color of the numeric values. If there are alarms, the numbers are displayed in yellow in Hi and L modes, and in red in HH and LL modes.

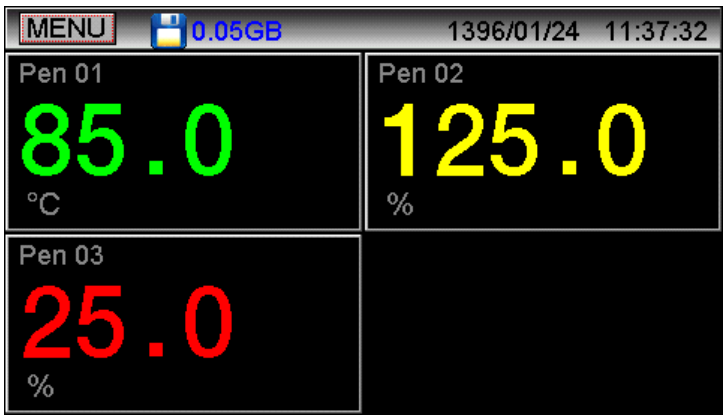


Figure 3.J: Displaying alarms in Black Indicator

- In the All para trend submenu, if there are alarms on each of the pens (as shown in Figure 3.K), the alarms are displayed in yellow in Hi and L modes, and in red in HH and LL modes in the numeric part of the pen with alarms.

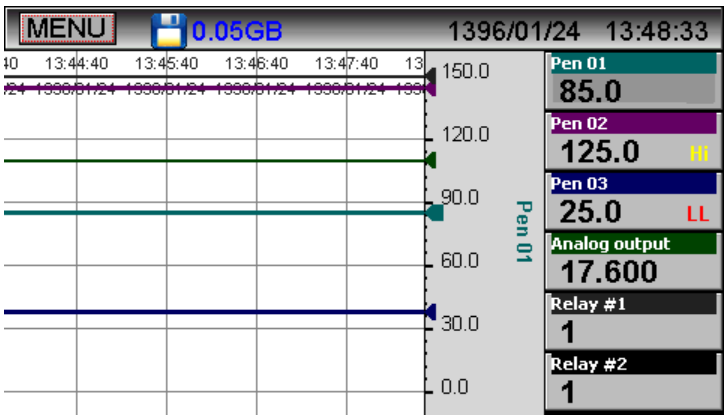


Figure 3.K: Displaying alarms in All para trend

Attachment 4

How to connect different signals to inputs:

This device has twelve 24-bit universal input channels with three-way 2KVDC electrical isolation that each channel containing three input pins. The pin number 1 is negative in all the input channels (-) and the pin number 2 is positive in all the input channels (+).

- If the input is a current type (mA), then the negative wire connects to pin 1 and positive wire connects to pin 2.
- If the input is a type of voltage, then the negative wire connects to pin 1 and the positive wire connects to pin 2.
- If the input is a type of thermocouple, then the negative wire connects to pin 1 and the positive wire connects to pin 2.
- If the input is a type of frequency, then the negative wire connects to pin 1 and the positive wire connects to pin 2.
- If the input is of the type RTD ← Due to the fact that this type of input has three wires, the common wire connects to pin 1 and the other two wires connect to pin 2 and 3. (To connect the temperature sensor, RTD PT100,… these sensors must be connected to the device in accordance with the RTD column in figure 1.)

  Figure A.4 shows how to connect different signals and sensors to the input of the device.

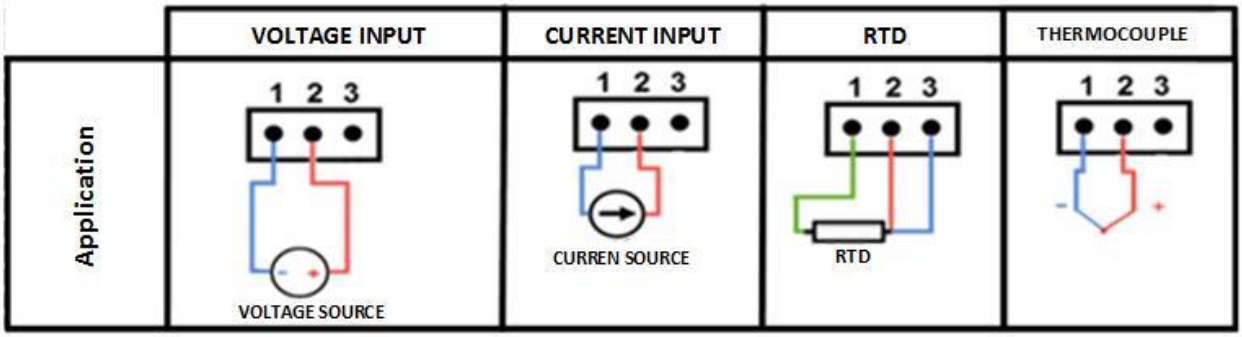


Figure A.4: How to connect different signals and sensors to the input

Input No. 1 is for RTD connection, input No. 2 is for connection of the pressure transmitter and the input No. 3 is for connecting the differential pressure transducer.

Outputs:

The connections on the back of the device are as shown in Fig. B-4:

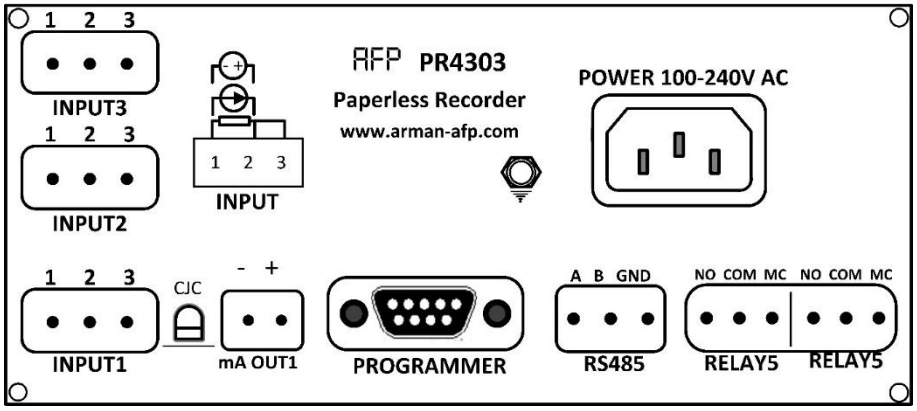
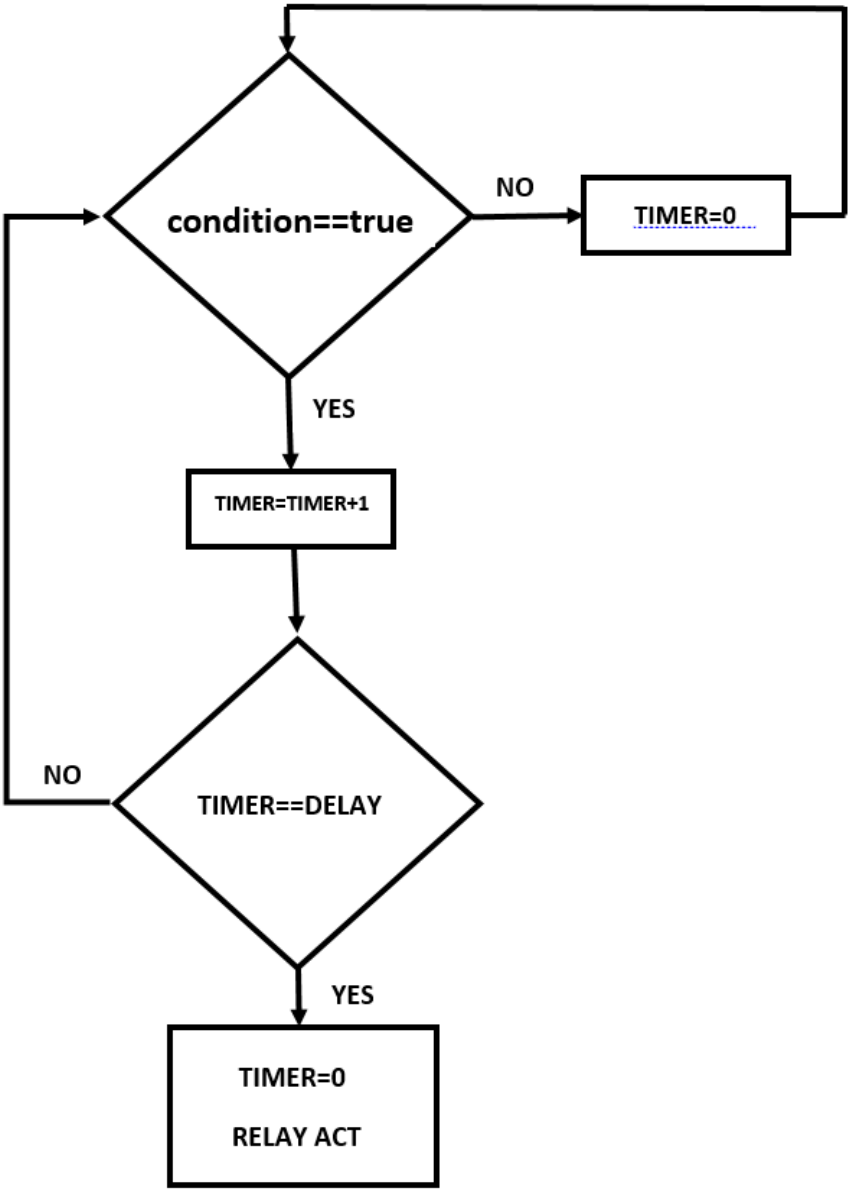


Figure B-4: Connections on the back of the device

Relay Output: This part is responsible for turning on or off the digital output (relay, SSR, OPEN, COLECTOR), and acts as Figure C-4.

First, the condition defined for the On condition is investigated; if this condition is met, the relay start-up timer starts counting. If the value of this timer reaches the On delay, the relay will turn on. If the On condition is not set, the timer turns on and resets. Further, if the relay condition for turning on was not set, the condition for switching off the relay is checked, and if this condition is set, the relay shutdown timer starts counting. And if the timer reaches the Off delay, the relay will turn off. If the condition for the Off condition is not set, the shutdown timer resets. (If needed, replace with ssr output and open collector.)

Figure C.4: How to operate output relays



Analog Output: The block diagram of the analog output section is shown in Fig. D-4. Analog output is based on milliamp. This value is calculated based on the settings for this section. Also, by activating the PID unit, you can use this section (output unit) to control a process.

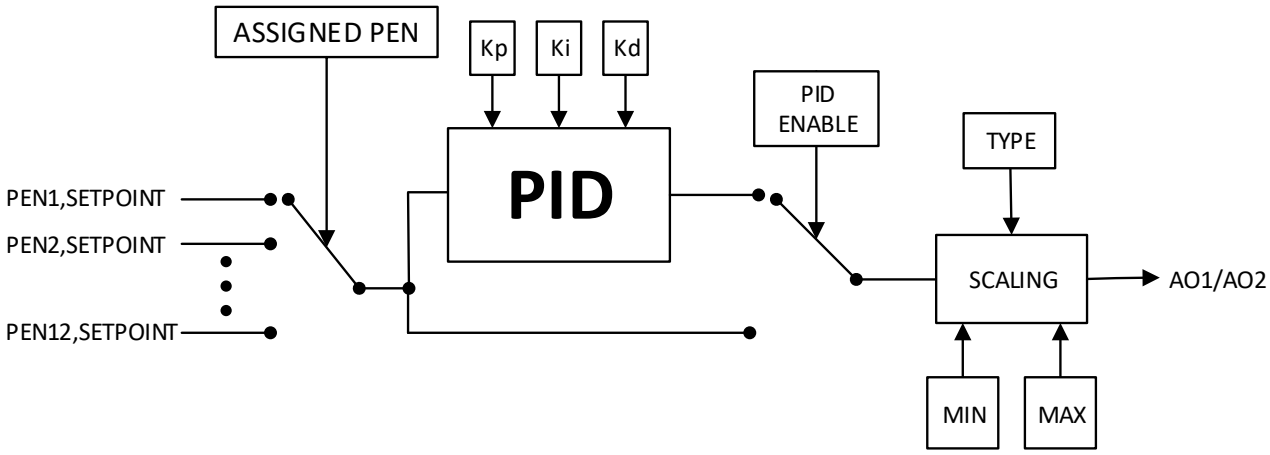


Figure D-4: Block diagram of the analog output section

Parameters related to this section are:

- **Assigned PEN:** This parameter determines the effective font in the calculations of this section.
- **Type:** This parameter specifies the analog output type and can be displayed as three consecutive modes: 4 ~ 20 mA 0 ~ 20 mA and 0 ~ 5 mA.
- **Min, Max:** By these two parameters, the millimeter output signal output range is set.
- **PID:** If this parameter is activated, the analog output value is updated based on PID calculations and updated with the parameters Set point, Kp, Ki, Kd and the current value of the selected pen.