
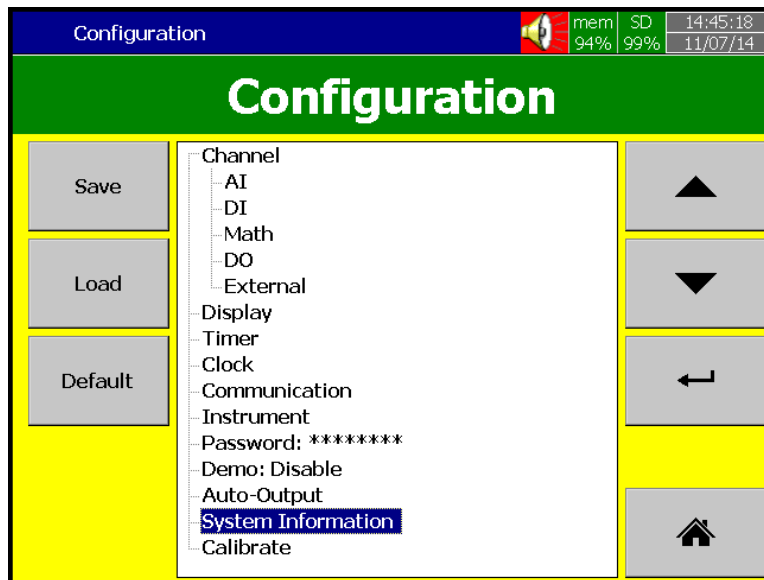


4. CONFIGURATION

Press  ("Menu"), then the **"More"** soft button to enter Configuration mode. A vertical list appears with a provision to configure Channel, Tools, Message, Display, Instrument, Security, Auto-Output, Demo, and system Information. In addition, the Save, Load, Default and Home soft buttons also appear.



Soft buttons



Enter key



Up directional key



Down directional key



Home key

Various options are available to enter into configuration mode

Option-1: Select the mode by pressing up & down directional keys, then press **"Enter"** key

Option-2: Select the required mode directly with a touch, then press **"Enter"** key

Option-3: Select the required mode by pressing the mode two times quickly, it is same as a double click from a mouse

Save: Save configuration from the recorder to a USB Stick or an SD Card.


To read the configuration from a USB Stick for the first time or any time the configuration has been changed, it is important to press the “Save” soft button to save configuration changes to the USB Stick or SD Card beforehand.

Load: Load configuration from a USB stick or SD Card to the recorder.

Default: If the configuration is set incorrectly, “Default” is a useful key to recall the default settings for the analog input card inserted into rear expansion slot.

Home: Returns the User to the home page.

4.1 Channel

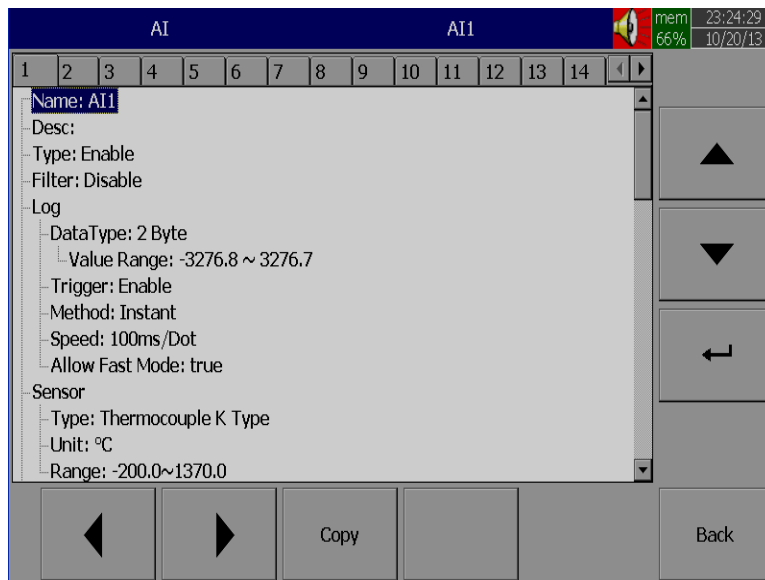
Path:  (Menu)-More-Config-Channel

AI
DI
Math
AO
DO
External

This section is to configure different type of channels. Analog Input (AI), Digital Input (DI), Math, Analog Output (AO), Digital Output and External device channels.

4.1.1 Analog Input

After entering the Configuration mode, in “Channel”, select “AI”, then Press the “Enter” key to get into Analog Input Channel mode. It displays the Analog input **AI1** as the first analog input channel configuration page. Press directional keys < > at the bottom to select other channels. Press directional keys ↑ ↓ on the right hand side to select the column. **After completing Configuration, press “Back” soft button, then press “Home” soft button to return to main display. All configurations will be saved automatically.**



Copy: For example, to copy the channel configuration from channel 1 to channel 2, select the source channel, in this case AI1 (or whatever the channel is named), press on “Copy” button. Now, a “Paste” button will get enabled, go to target channel, say channel 2, and then press on “Paste” button.

Name: Enables the User to define the name for each channel with a maximum of 18 characters.

Select “Name”, then Press “**Enter**”, soft button, a keyboard with several keys appear. Press “**Shift**” to select special characters. Press “**Caps**” to select capital letters. Press soft key “**OK**” after entering a new channel name.

Desc: The description about a specific channel on the display.

Type: Option available to enable or disable the channel from selection

Filter: It is to reduce the noise of input signal before sampling. It is possible to select range from 1 to 16 sec. It is a soft filter available to reduce fast variation of analog inputs. It gives a moving average value. For example, if the filter value is set as 5 sec for AI1, it means all the samples collected in the last 5 sec shall be averaged, and the value is available to record as per Log method.

Log:

Data Type: 2 byte

2 byte range: -32767 to +32767

Trigger: Two options are available

- a) Disable: Select disable while the recording of a specific channel is not required at this time
- b) Enable: Select Enable while the recording of a specific channel is required at this time

Method: This is the method of logging measured data. Select the column and press “enter”. Then choose the Log method of Instant, Average, Minimum or Maximum data.

Instant: logging the last measured data at the sampling interval

Average: logging the averaged measured data at the sampling interval

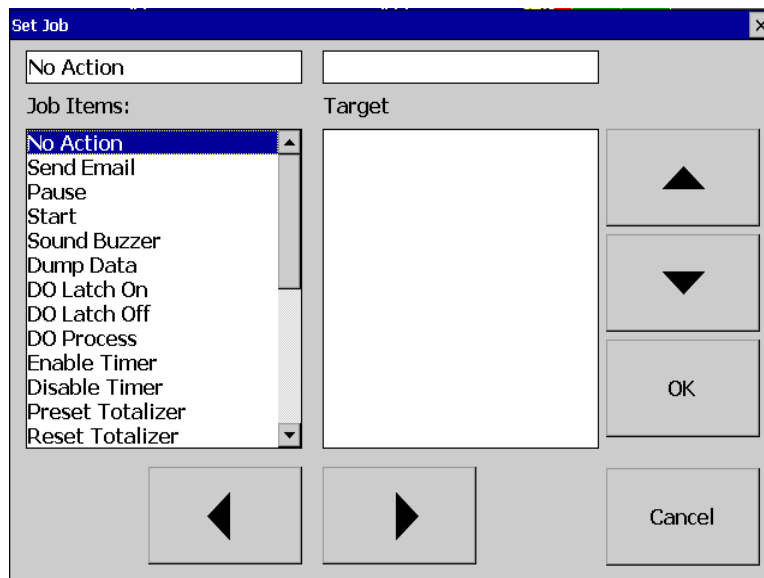
Minimum: logging the minimum measured data at the sampling interval

Maximum: logging the maximum measured data at the sampling interval

Speed: It is the logging speed (recording speed) of measured data. Select Log Speed column, then choose one of the following

100ms/Dot
1 Sec/Dot
2 Sec/Dot
5 Sec/Dot
10 Sec/Dot
20 Sec/Dot
30 Sec/Dot
1 Min/Dot
2 Min/Dot

(Auto)Set Jobs under Events



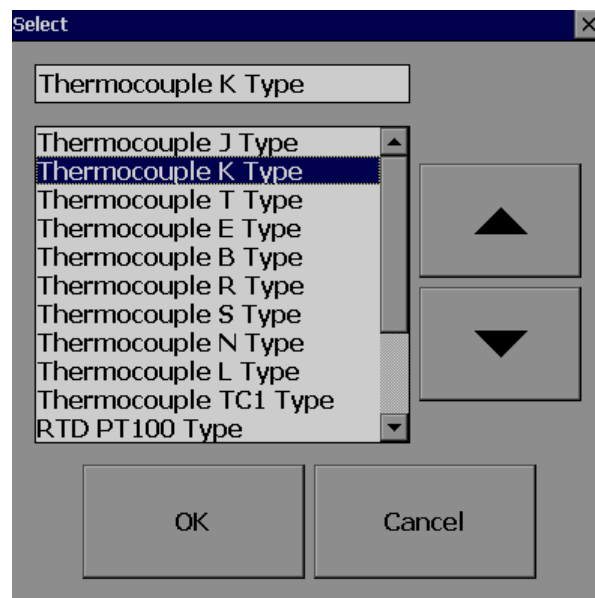
Sensor

Type: Thermocouple K Type, °C

Unit: °C

Range: -200.0~1370.0

Type: Select the sensor input type for the Channel.



RTD JPT100 Type

RTD RTD1 Type

Milli-Volts

Volts

Current

Unit: The engineering unit of input.

Range: Select based on Sensor type

Select
-200.0~1370.0
-200~1370
-200.0~1370.0

Sensor	Select
Type: Milli-Volts	0~1000
Unit: mV	0~60
Range: 0~1000	0~1000
	-60~60

Sensor	Select
Type: Volts	0~5
Unit: V	0~10
Range: 0~5	0~5
	1~5
	-2~2
	-20~20

Sensor	Select
Type: Current	4~20
Unit: mA	0~20
Range: 4~20	4~20
	-20~20

Scale: Appears only for linear inputs Ex: mV, Voltage, current etc..

Scale
Unit: °C
Low: -120.0
High: 1000.0

Offset: It is offset value to correct the sensor error.

Gain: It is a multiplier to correct the sensor error.

The correct value = (the process value x gain) + offset

Events

Events are frequently used for Alarm purposes. Events can also be used for digital outputs (DO), Timer, Totalizer, Counter or Report.

Maximum five events are possible to set for each Analog Input

Press "Add" to add new event

Press "Remove" to remove selected event

Events
Add
Remove
1
Type: H
SetPoint: 776.0
Log: Log Alarm
Job1: No Action
Job2: No Action
Hysteresis: 0.0

Type: There are various types of H, L, HH, LL, Dev+, Dev-, and Error to be selected for a job

or Alarm purpose

H: High limit. When the process is over high limit, the alarm or job is actuated.

L: Low limit. Any the process is lower than low limit, the alarm or job is actuated

HH: High high limit, to set up another limit higher than high limit for double warning.

LL: Low low limit, to set up another limit lower than low limit for double warning.

Dev+: Trigger event on positive deviation of process value. The job or alarm is activated when process value is deviated by greater than the setpoint+the process value.

For example:

Set point =10

At 10.00.01 Hrs, Tag1=40

At 10.00.02 Hrs, Tag1 = 51

Then, job or alarm is activated

Dev-: Trigger event on negative deviation of process value .The job or alarm is activated when the process value is deviated by less than the set point-the process value.

For ex: Set point =10

At 10.00.01 Hrs, Tag1=40

At 10.00.02 Hrs, Tag1 = 29

Then, job or alarm is activated.

Error: On channel error, an alarm or job is activated

Setpoint: To set up the process value for actuating Job1 and /or Job2

Alarm

Log Alarm: Record alarms

Log Alarm (Auto Ack): Record alarms and acknowledge automatically

Log Event: Record events

Job1, Job2: When an event occurs, the task to be performed is called the job. A typical example is to trigger **an alarm buzzer** in the event of a high temperature. Each pen can accept five different types of events (or alarms) and each event can create two jobs. Please note that a job under Event is different from a job created by pressing the **Operate** key. The former is actuated by an event, and the latter is actuated by manual control, no event necessary.

Note: Please refer to the section “Jobs” for full details about various jobs available

Hysteresis: To avoid it been activated too often, the Log Alarm or relay can set for no reaction. Hysteresis value can be defined for the event trigger set point

Example1

If the temperature is increased to more than 120 °C, log alarm and switch on digital output 1. When the temperature is decreased to less than 80 °C, log the alarm and switch off the digital output1.

Setting of events for the analog input in the channel configuration is as follows..

Events

Add

Remove

1

Type: H

SetPoint: 120.0

Log: Log Alarm

Job1: DO Latch On_DO1

Job2: No Action

Hysteresis: 0.0

2

Type: L

SetPoint: 80.0

Log: Log Alarm

Job1: DO Latch Off_DO1

Job2: No Action

Hysteresis: 0.0

4.1.2 Digital Input

Path:  (Menu)-Config-DI

After entering the Configuration mode, in the Channel, select DI then Press the “Enter” soft button to get into Digital Input Channel configuration page.

DI				
1	2	3	4	
Name: DI1				
Desc: Tank level high				
Type: Logic Level				
Events				
Add				
Remove				

Name: Define the name for the Digital Input Channel. A maximum of 18 characters is allowed for the name.

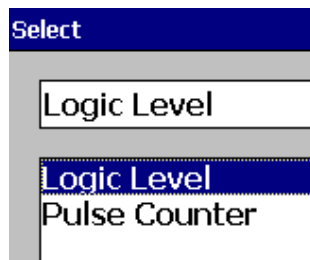
Description: Define detail description for the channel.

Type: Logic Level

Logic Level: This selection activates digital logic, which is either one or zero with low frequency which is less than 1Hz, such as an external relay.

Pulse Counter: With this selection, we can feed high speed inputs (high Frequency, up to 100Hz)

Select Logic Level and press “Enter” key



Events: A maximum of 2 events are supported for every digital Input channel.
A maximum of two jobs can be configured for each event.

**Note: Events will not appear if Logic Level selected as Pulse Counter*

Add: Press “Add” to add events to the Digital Input

Remove: Press “Remove” to remove events from the Digital Input

Type: Select Low, L or High, H

Job1, Job2: To configure a Job, select Job1, the press the Enter button. It will show a list of all the available jobs. Select the required Job.

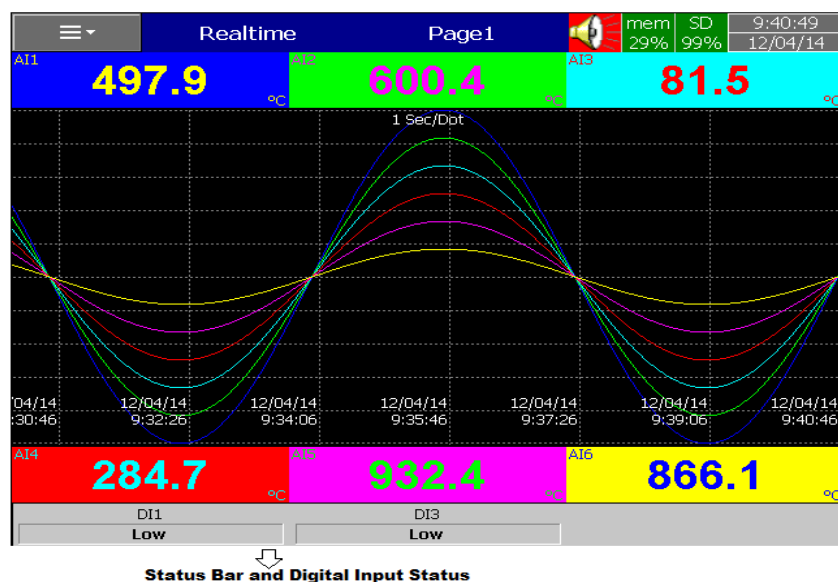
Note: Number of digital inputs shown on the DI screen depends on number of Digital input cards inserted in the paperless recorder.


Sample applications of Digital input ...



After pressing a “Start” switch, latch ON Digital Output1
After pressing a “Pause” switch, latch Off Digital Output1
Start Timer, Stop Timer
Reset Totalizer, Reset Counter
Reset MaxMinAve values of all the channels etc..

It is possible to display Digital input status via status bar on any page in the paperless recorder. If digital input is not enabled, it shows as “Low”. Presence of an enabled digital input shall be shown as “High”. See the picture below.

To configure status bar, refer section “Display”




Digital Input status can also monitored from the  (Menu). Press “Status” and then select “DI”, it will show the Digital Input Status as follows.

Menu			Status			DI			 mem 84%		12:49:57 02/17/13		
DI	DO	AO	Counter	Totalizer									
No	Name			Value		Desc							
1	DI1			Hi		Tank1 Level switch high							
2	DI2			Low		Tank2 Level Switch High							
◀			▶			▲			▼				

4.1.3 Math Channel

Maximum no. of Math channels in various PR series Recorders are as follows

PR Recorder	PR-10	PR-20	PR-30
Maximum Math Channels	15	40	60

Path:  (Menu)-More-Config-Math

After entering the Configuration mode, in Channel, select Math, then Press the “Enter” soft button to get into Math Channel configuration page.

Math									
1	2	3	4	5	6	7	8	9	
Name: Math1									
Desc: Math channel 1									
Type: Math									
Log									
DataType: 4 Byte									
Value Range: -3.4E+38 ~ 3.4E+38									
Trigger: Enable									
Method: Instant									
Speed: 100ms/Dot									
Expression: (AI1+AI2)/2									
Scale									
Unit:									
Transformation: Disable									
Decimal: 1									
Range: -214748364.8 ~ 214748364.7									

Name: Define the name of the Math channel

Desc: Define the detail description for the channel name

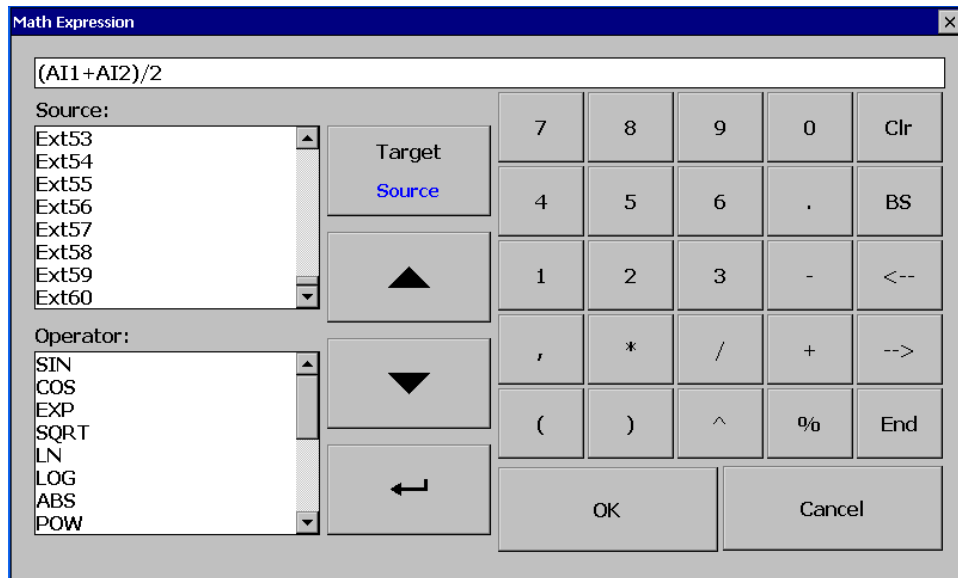
Type: Specify either Math, Totalizer or Counter

Note: Based on selection at “Type”, configuration details will be changed. For ex:
Type=Math has different configuration details compared with Type = Totalizer or Type = Counter

Log data type, Trigger, Method, Speed: Same as Analog Input

Press **Back** key and then press “**Home**” soft button go to Real time display and memorize the Math settings.

Enter Expression column, it appears Source, Operator and a keyboard.



The Source covers all available Analog inputs, Digital Inputs, Math inputs, external channels.

The Operators are mathematical expressions described below.

Use Source, Operator and keyboard to define the Math equation.

Scale
 Unit: Tons
 Transformation: Value
 Table: Point 1 to 8
 Range: 0 ~ 170

Transformation: Select disable, value or Math channel. This function mainly used to display process values obtained from Non-linearization table

Table: Select disable, value or Math channel

Maximum 64 rows can be entered in the Transformation table

Ex: A chemical tank has a non-linear shape. The level is 0 to 1400 cms. The Recorder should display 0 to 170 Tons as per following table

No	Input	Output
1	0	0
2	200	10
3	400	30
4	600	80
5	800	130
6	1000	150
7	1200	160
8	1400	170

Add: Press “Add” soft button to add a new row into the Transformation table

Delete: Press “Delete” soft button to delete existing row from the Transformation table

Copy: Press to copy existing row in the Transformation table to create a duplicate entry

Mode: Press to toggle between Input and Output entries in the Transformation table

Up & Down: To navigate among rows in the Transformation table

4.1.3.1 Math Expression

Expressions	Mathematics Functions
+	Addition
-	Subtraction
*	Multiplication
/	Division
SIN(x)	$\sin(x)$
COS(x)	$\cos(x)$
EXP(x)	e^x
SQRT(x)	Square root of x
LN(x)	$\log_e(x)$
LOG(x)	$\log_{10}(x)$
ABS(x)	Absolute of x
POW (x,y)	x^y
ROUND(x)	The closest integral number to x
HI(x,y)	The bigger value between x and y
INV(x)	$1/x$
TG(x)	$\tan(x)$
CTG(x)	$1/\tan(x)$
ASIN(x)	$\sin^{-1}(x)$
ACOS(x)	$\cos^{-1}(x)$
ATG(x)	$\tan^{-1}(x)$
x%y	Remainder of x/y
x^y	x^y

4.1.3.2 Math Example-1

Relative Humidity – PR20 Math application

*How to Calculate Relative Humidity - Theory

Requirement: Two Analog Inputs, Type: RTD

AI1: To measure dry bulb temperature

AI2: To measure wet bulb temperature

First calculate the saturation vapor pressure (E) for both the dry-bulb (Td) and wet-bulb (Tw) temperatures using the following equations:

$$E_w = 0.61078 * \text{EXP}((17.269 * T_w) / (T_w + 237.3)) * (T_d - T_w)$$

$$E_d = 0.61078 * \text{EXP}((17.269 * T_d) / (T_d + 237.3)) * (T_d - T_w)$$

In the above equations the temperatures units are Celsius and the saturation vapor pressure units are millibars. The function "EXP" is the exponential and not raising something to an exponent.

Then calculate actual vapor pressure (Ea) using the following equation:

$$E_a = E_w - 0.63 * (T_d - T_w)$$

Relative Humidity is then calculated using the following equation:

$$RH = (E_a / E_d) * 100$$

The units of relative humidity are in percent.

Here is an example of the using the equations:

Assume that your dry-bulb temperature (Td) = 40 C and your wet-bulb temperature (Tw) = 30 C.

$$E_w = 0.61078 * \text{EXP}((17.269 * T_w) / (T_w + 237.3)) * (T_d - T_w)$$

$$E_w = 0.61078 * \text{EXP}((17.269 * 30) / (30 + 237.3)) * (40 - 30)$$

$$E_w = 42.4262 \text{ millibars}$$

$$E_d = 0.61078 * \text{EXP}((17.269 * T_d) / (T_d + 237.3)) * (T_d - T_w)$$

$$E_d = 0.61078 * \text{EXP}((17.269 * 40) / (40 + 237.3)) * (40 - 30)$$

$$E_d = 73.7416 \text{ millibars}$$

$$E_a = E_w - 0.63 * (T_d - T_w)$$

$$E_a = 42.4262 - 0.63 * (40 - 30)$$

$$E_a = 36.1262 \text{ millibars}$$

$$RH = (E_a / E_d) * 100$$

$$RH = (36.1262 / 73.7416) * 100$$

$$RH = 48.99 \%$$

* End of Theory

5 Math channels are required to calculate one RH.

Td = AI1, analog input for dry bulb temperature (PT100)

Tw = AI2, analog input for wet bulb temperature (PT100)

Math1 = EXP ((17.269*AI1)/ (AI1+237.3))

Math2 = Ed1 = 0.61078*Math1*(AI1-AI2)

Math3 = EXP ((17.269*AI2)/ (AI2+237.3))

Math4 = Ew1 = 0.61078*Math3*(AI1-AI2)

Ea = Ew - 0.63 * (Td - Tw)

Math5= RH1 = ((Math4-0.63*(AI1-AI2))/Math2)*100

Name: Math1
Desc: Math Channel 1
Type: Expression
Log
Expression: EXP((17.269*AI1)/(AI1+237.3))

Name: Math1
Desc:
Type: Math
Log
 DataType: 4 Byte
 Value Range: -3.4E+38 ~ 3.4E+38
 Trigger: by Time
 Method: Instant
 Speed: 1 Sec/Dot
Expression: EXP((17.269*AI1)/(AI1+273.3))

Name: Math2
Desc:
Type: Math
Log
 DataType: 4 Byte
 Value Range: -3.4E+38 ~ 3.4E+38
 Trigger: by Time
 Method: Instant
 Speed: 1 Sec/Dot
Expression: 0.61078*Math1*(AI1-AI2)

- Name: Math3
- Desc:
- Type: Math
- Log
 - DataType: 4 Byte
 - Value Range: $-3.4E+38 \sim 3.4E+38$
 - Trigger: by Time
 - Method: Instant
 - Speed: 1 Sec/Dot
- Expression: $\text{EXP}((17.269 \cdot \text{AI2}) / (\text{AI2} + 273.3))$

- Name: Math4
- Desc:
- Type: Math
- Log
 - DataType: 4 Byte
 - Value Range: $-3.4E+38 \sim 3.4E+38$
 - Trigger: by Time
 - Method: Instant
 - Speed: 1 Sec/Dot
- Expression: $0.61078 \cdot \text{Math3} \cdot (\text{AI1} - \text{AI2})$


- Name: Math5
- Desc:
- Type: Math
- Log
 - DataType: 4 Byte
 - Value Range: $-3.4E+38 \sim 3.4E+38$
 - Trigger: by Time
 - Method: Instant
 - Speed: 1 Sec/Dot
- Expression: $((\text{Math4} - 0.63 \cdot (\text{AI1} - \text{AI2})) / \text{Math2}) \cdot 100$

Now, in Math5, you will get Relative humidity in %

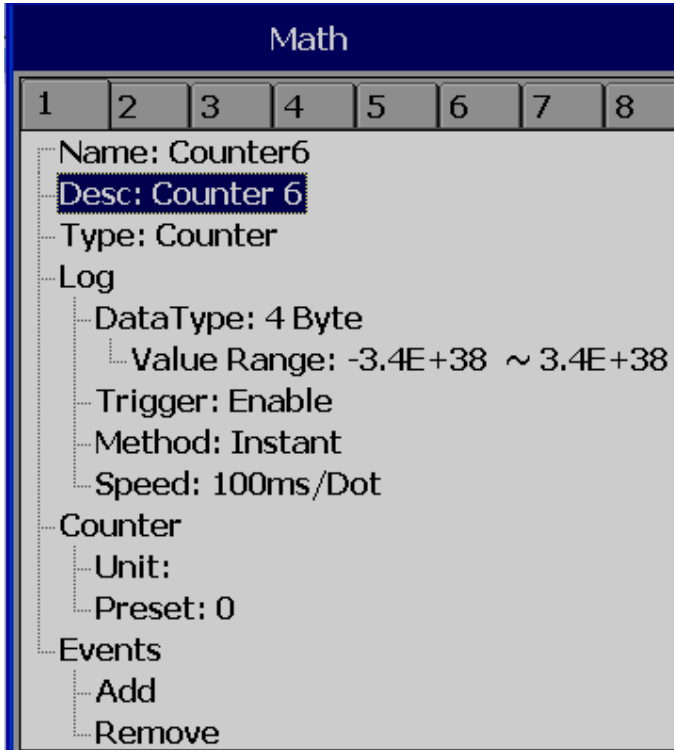
Five events are supported for every Math channel and two jobs are available in every event, the same as the Analog input channel.

Math channels are virtual channels. They contain measured values based on equations. These values can be recorded similar to physically connected Analog inputs and display digital values, trends, bar graphs etc.

4.1.3.3 Counter

Path:  (Menu)-More-Config/Math

Select **Type** = **Counter**



Press directional keys $\langle \rangle$ at the bottom to select one of the Math channel for the Counter operation.

Name: Defines the name of counter, max. 18 characters allowed

Desc: Defines the description for a specific counter on the display

Type: Select **Counter**

Counter

Unit: Defines the unit of counter

Preset: Defines the preset value for the counter.

Event: Defines the type, Set point, Log, Job1 or Job2 & Hysteresis

Type: Select one of the options: H, L, HH, LL, Dev+, Dev-, Error

Set point: Defines the set point trigger of Counter value to initiate Jobs and/or Log alarms

Log: Select Log Alarm, Log Alarm (Auto Ack.), or Log Event

Job1, Job2: various jobs can be assigned, 2 jobs for each counter

Hysteresis: To avoid jobs have been activated too often, it can set for no reaction.

Hysteresis value can be defined for the event trigger set point

4.1.3.4 Counter Example-1

The operator wishes to know the number of occurrences of an event in a day. Let's say the pressure switch in DI1 goes logic high

Digital input1 is used for a Pressure switch. High signal indicates High pressure, Low signal indicates normal pressure

DI	
1	2
Name: DI1	
Desc: Pressure Switch	
Events	
Add	
Remove	
1	
Type: H	
Log: No Action	
Job1: Inc Counter_Counter1	
Job2: No Action	

Timer						
1	2	3	4	5	6	7
Type: Daily						
Action: Enable						
Time						
Hour: 23						
Min: 59						
Sec: 1						
Job1: Log Report_Counter1						
Job2: Reset Counter_Counter1						

(Reset Counter1 historical data in order to log new data for the next day)

Archive historical data by pressing the following.

 (Menu)-Event-Report, Select Daily in the Mode

If values meet the following conditions, recorder will change notation from traditional to scientific

- the value is more than 10^5 or less than $1/(10^5)$
- the value digit-length in display exceeds the allowed range

Ex: Up to 5 digits, counter displays value directly, let's say 0-99999.

100000 will be shown as 1E5, which means 5 zero's after 1

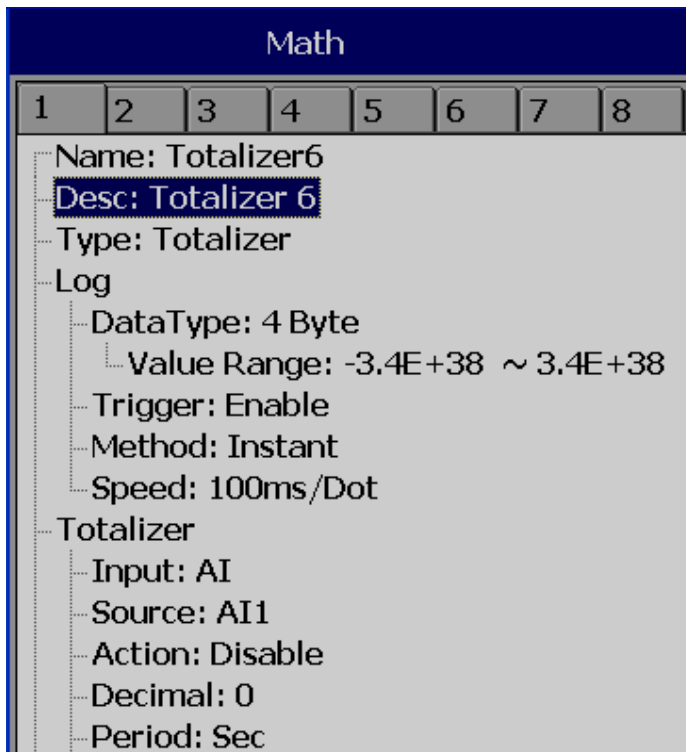
4294967295 will be shown as 4.29497E9 etc.

4.1.3.5 Totalizer

In our new generation Recorder, the Totalizer is a part of Math channels.

Configuration Path:  (Menu)-More-Config-Math

Select **Type = Totalizer**



Press directional keys < > at the bottom to select from available Totalizers

Name: Defines the name of the Totalizer, Maximum 18 characters allowed

Desc: Defines the description for a specific Totalizer on the display

Type: Select "Totalizer"

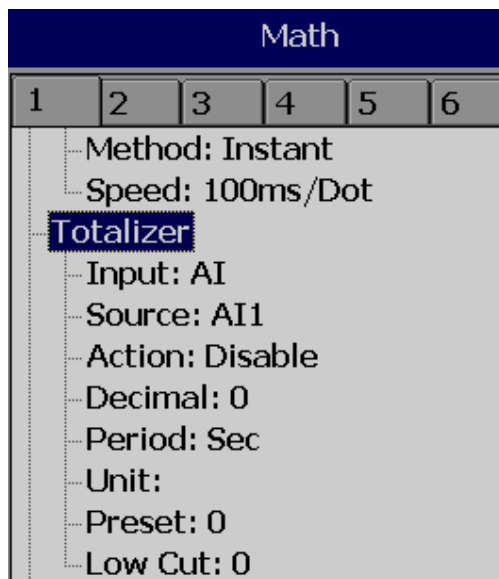
Log: Same as Analog input configuration

Totalizer:

Input: Analog Input (AI) or Pulse Counter (DI)

Source: Select the source for the Totalizer from Analog input/Math/Counter/Totalizer

Action: Disables or enables the Totalizer



Decimal: Defines the decimal point for the Totalizer

Period: Selects if seconds, minutes or hours are used for the Totalizer

Unit: Defines the unit of totalizing

Preset: Defines the preset value for the Totalizer.

Low Cut: Defines the Low Cut for the Totalizer.

For ex: If 0.0 is set as Low cut, then, if source channel AI1 is less than 0.0, the Totalizer value will not go to negative.

Event: Total 5 events are supported for each Math channel. Defines the type, Set point, Log, Job1 or Job2 & Hysteresis

Type: Select one of options, H, L, HH, LL, Dev+, Dev-, Error

Set point: Defines the set point trigger of Totalizer value to initiate Jobs and/or Log alarms

Log: User can select one of Log Alarm, Log Alarm (Auto Ack.), or Log Event

Job1, Job2: various jobs can be configured, 2 jobs for each Totalizer

Hysteresis: To avoid jobs from being activated too often, the hysteresis can set to avoid nuisance tripping. Hysteresis values can be defined for the event trigger set point

4.1.3.6 Totalizer Example-1

Water flow rate is in M³/Sec. The operator wants to know about total water discharged and wants this information in daily, weekly and monthly reports

```
Name: Totalizer1
Desc:
Type: Totalizer
Log
  DataType: 4 Byte
  Value Range: -3.4E+38 ~ 3.4E+38
  Method: Instant
  Speed: 1 Sec/Dot
```

Timer						
1	2	3	4	5	6	7
Type: Daily						
Action: Enable						
Time						
Hour: 23						
Min: 59						
Sec: 1						
Job1: Log Report_Totalizer1						
Job2: Reset Totalizer_Totalizer1						

Reset Totalizer1 historical data in order to log new data for the next day

Archive historical data by pressing the following.

Path:  (Menu)-Event-Report

Select **Daily** in the **Mode** to see reports on daily basis. To navigate to another day, press on Left and right arrows below the **Mode** button. Select **Weekly** in the **Mode** to see weekly reports, or select **Monthly** on the **Mode** to see Monthly reports.