

OPERATING MANUAL



Mother Nature tells you everything

Paperless Recorder Model No.: 62xx...

Manufacturers of :

- Circular Chart Recorders
- Strip Chart Recorders
- Hygro-Thermographs
- Inkless Recorders
- Scanners & Data Loggers



g-tekTM
Record it...
Control it...
Perfect it.

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3 INTRODUCTION

This manual will help user to get acquainted with the installation and operation of the Paperless Recorder. Paperless Recorder has multiple options to view data such as the digital view, horizontal bar graph, vertical bar graph, horizontal line graph, vertical line graph and polar graph. There are several options to group channels, view them separately, change batch setup, system setup and others.

3.1 MANUAL LAYOUT

This manual is divided into several sections for quick and easy reference.

Section 1 List of Figures and Tables	This section enlists all the tables and figures for user's reference.
Section 2 Introduction	This section gives an outline of the manual, a brief description about the paperless recorder and its dimensions.
Section 3 Installation	This section gives the details about mechanical and electrical installation.
Section 4 Menu	This section describes the diverse options available such as batch config, system config and others.
Section 5 Current Data Display	This section describes how to view current data in digital as well as graphical form
Section 6 Troubleshooting guide	This section describes the most frequently asked questions and their solutions.
Section 7 Specifications	It describes the detailed specification of the Paperless Recorder.

3.2 INSTALLATION

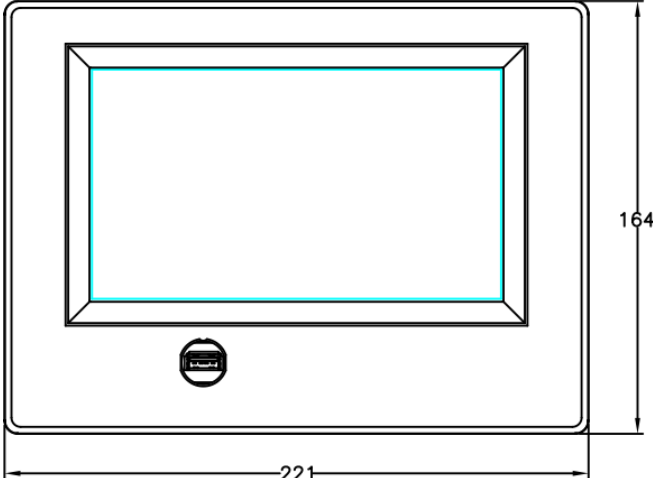


Figure 1- Overall Dimensions (Height and Width)

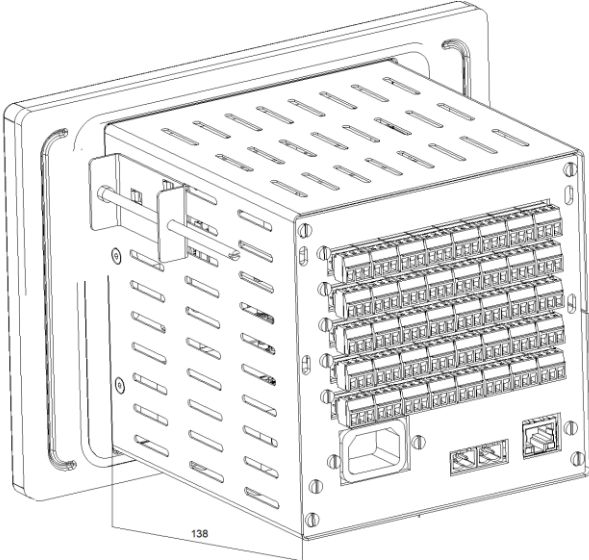


Figure 2- Overall Dimension (Depth)

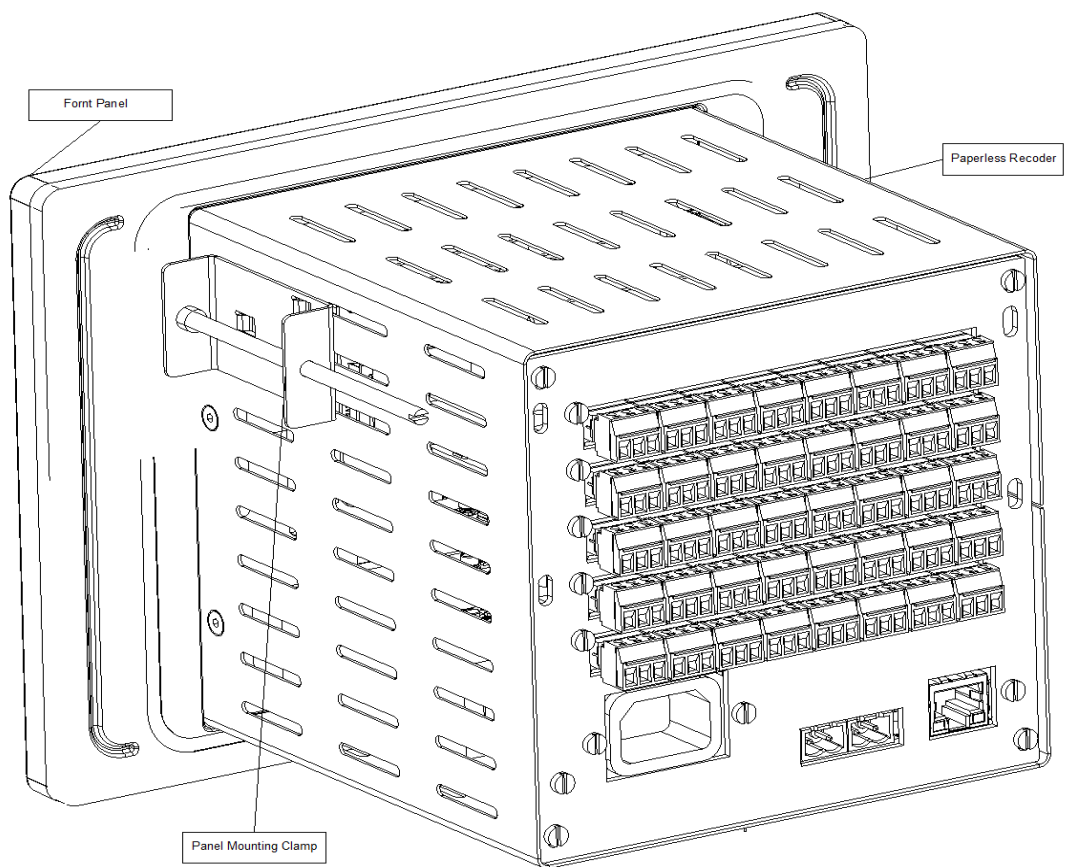


Figure 3- Panel Mounting

3.3 ELECTRICAL INSTALLATION

General information



Warnings

To comply with Underwriter Laboratories (UL) and Canadian Standards Association (CSA) certification, route signal leads and power cables in earthed (grounded), flexible metal conduit. Connect proper Earth to the earthing terminal of the Paperless Recorder.

- Instruments not fitted with the optional internal on/off switch and fuse must have a disconnecting device such as a switch or circuit breaker conforming to local safety standards fitted to the final installation. It must be fitted near the instrument within easy reach of the operator and must be marked clearly as the disconnection device for the instrument.
- Remove all power from supply, relay and any powered control circuits and high common mode voltages before accessing or making any connections.
- Use cable appropriate for the load currents. The terminals accept cables up to 14AWG (2.5mm²).
- The instrument and all inputs and outputs conform to Mains Power Input Insulation Category II.
- All connections to secondary circuits must have basic insulation.
- After installation, there must be no access to live parts e.g. terminals.
- Terminals for external circuits are for use only with equipment with no accessible live parts.
- If the instrument is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.
- All equipment connected to the instrument's terminals must comply with local safety standards (IEC 60950, EN601010-1).

NOTE:

To ensure maximum recorder performance, proper wiring installation practices must be followed. Failure to do so can result in a range of problems, from loss of configuration to component failure, caused by transmitted or radiated electrical noise. Proper consideration must be given to local noise sources and appropriate suppression steps taken to minimize any potential problems. Among the most common sources of noise are: Relays, SCRs, valve solenoids, electric motors, power line disturbance, wire-to-wire coupling, electrostatic discharge (ESD) and radio-frequency interference (RFI).

To achieve the best results, the following notes should be considered:

1. Low level signal wiring such as that associated with thermocouples, RTDs and current loops should always be kept separate from power and control output wiring.
2. Signal input wiring should be twisted pairs/triplets etc. The conductors should be stranded rather than solid in construction. All signal wiring should use ground-shielded wires or be routed through grounded conduit to minimize the effects of RFI and ESD.
3. Exceptional care should be taken when wiring to relay or solenoid coils, as large transients are produced when coils (or any other inductive loads like motors or arc welding equipment's etc.) are switched. This problem can be eliminated using suitable suppression devices across the coil. Coil transients can also be transmitted through the air, so the recorder itself should be mounted as far as possible from power control devices and/or wiring.
4. When line power is poorly regulated and / or subject to voltage surges or transients, consideration should be given to the use of a line conditioning/transient suppressing line power regulator. Process control motors, valves, relays and heaters should not be connected to the same power lines that are used for instrumentation.
5. The connection of the Paperless Recorder to a proper safety earth ground is essential. Such a connection not only reduces the possibility of electric shock, but also provides the required return for the Paperless Recorder line power filters.
6. All local electrical codes of practice must be followed when installing any instrumentation.

3.3.1 Wiring diagram for Paperless Recorder

Check for proper Earthing:

Proper Earthing is necessary for best performance of the Paperless Recorder. Follow the steps mentioned below to check whether the earthing given is proper or not:

- Find out the Phase line of connection with the help of “Tester with Neon Lamp”. When Neon Lamp glows, it is an indication of the phase line.
- Once Phase is found, the other hole which is in line of phase is the Neutral line.
- The third hole which is apparently bigger in diameter is the Earthing line.
- Now take the voltmeter with appropriate measurement range (normally 750VAC or higher) and put the probes into PHASE and NEUTRAL line and take reading.
- The voltage across PHASE and EARTH, and NEUTRAL and EARTH.
- The voltage between Neutral and Earth Should not be more than 6V. If by any chance, it is more than 30V, it is a serious fault on earth line. And must immediately be corrected.

Proper Earthing is essential for safety of the personnel and for the proper functioning of the equipment.

Note: If connecting the instrument in the panel, panel and Paperless Recorder both should be at the same earthing potential.

See the back panel of the Paperless Recorder, you will find all the connectors for wiring. As shown in the following figure.

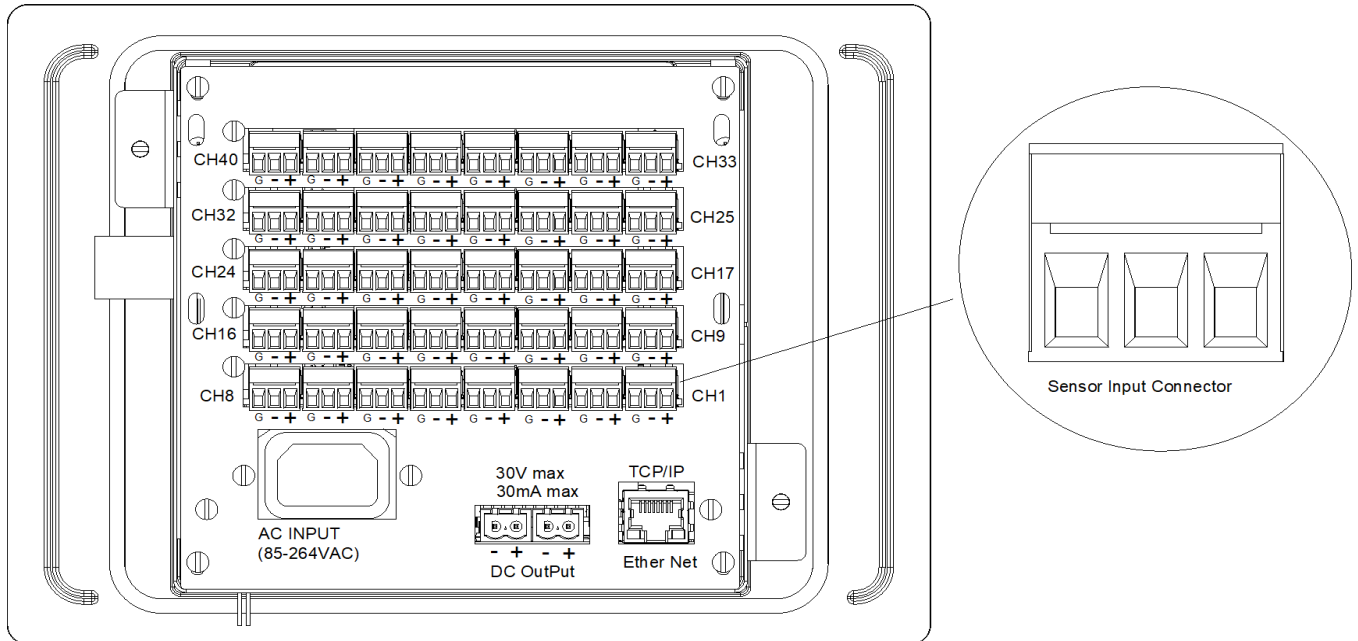


Figure 4- Back Panel of Paperless Recorder

The Paperless Recorder can be connected and configured to operate with a variety of signal sources as thermocouple, RTD, DC current, DC voltage etc. The sensor wiring for different sensors is shown as below:

3.3.1.1 Sensor wiring

To ensure maximum performance of Paperless Recorder, proper wiring installation practices must be followed. Failure to do so can result in a range of problems, from loss of configuration to component failure, caused by transmitted or radiated electrical noise. Proper consideration must be given to local noise sources and appropriate suppression steps taken to minimize any potential problems.

Among the most common sources of noise are: Relays, SCRs, valve solenoids, electric motors, power line disturbance, wire-to-wire coupling, electrostatic discharge (ESD) and radio-frequency interference (RFI).

1. To achieve the best results, the following notes should be considered:
Low level signal wiring such as that associated with thermocouples, RTDs and current loops should always be kept separate from power and control output wiring.
2. Signal input wiring should be twisted pairs/triplets etc. and the conductors should be stranded rather than solid in construction. All signal wiring should use ground-shielded wires or be routed through grounded conduit. This minimizes the effects of RFI and ESD.
3. Care should be taken when wiring to relay or solenoid coils, as large transients are produced when coils (or any other inductive devices) are switched. This problem can be eliminated using suitable suppression devices across the coil. Coil transients can also be transmitted through the air, so the recorder itself should be mounted as far as possible from power control devices and/or wiring.
4. When line power is poorly regulated and / or subject to voltage surges or transients, consideration should be given to the use of a line conditioning/transient suppressing line power regulator. Process control motors, valves, relays and heaters should not be connected to the same power lines that are used for instrumentation.
5. The connection of the Paperless Recorder to a proper safety earth ground is essential. Such a connection not only reduces the possibility of electric shock, but also provides the required return for the recorder line power filters.
6. All local electrical codes of practice must be followed when installing any instrumentation.

3.3.1.1.1 Sensor wiring - RTD (Pt-100) 3-wire input

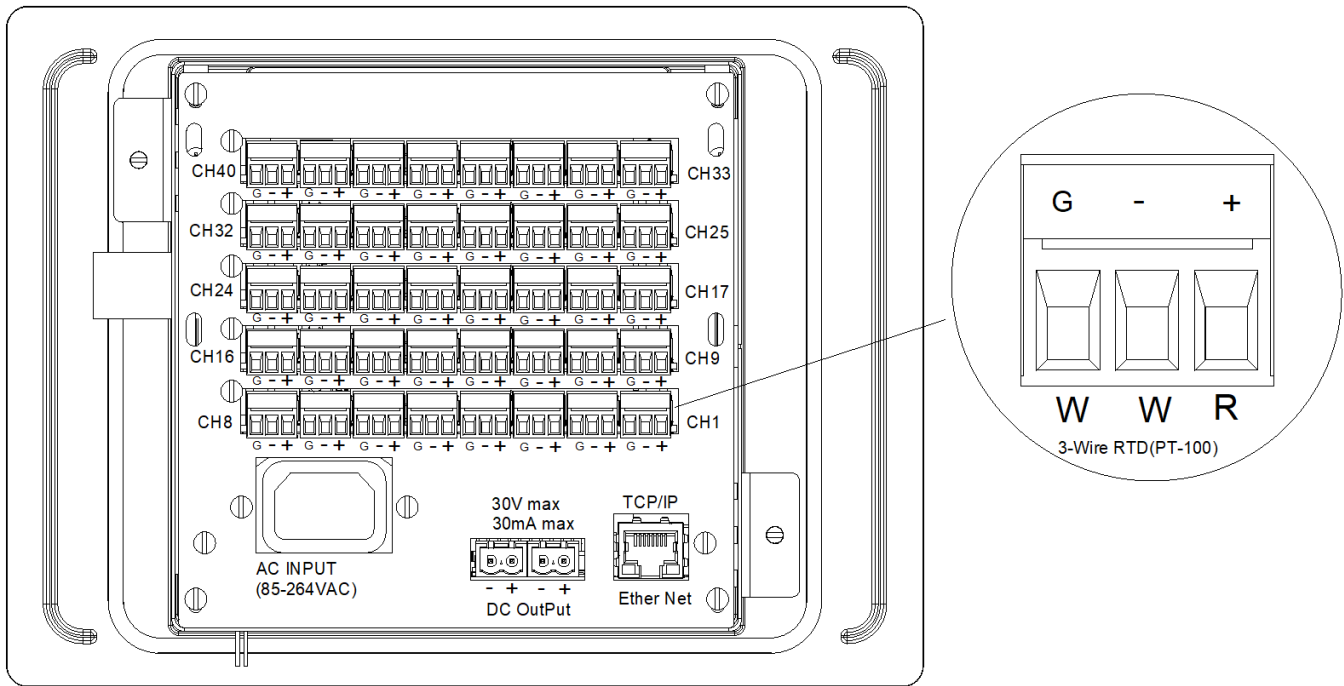


Figure 5-Sensor Wiring - RTD (Pt-100) 3-Wire Input

The connection for 3-wire RTD (Pt-100) sensor is shown in figure 5. Normally RTD (Pt-100) sensor with 3-wires has two similar color wires and other one distinct color. Connect two similar color wires at '-' and 'G' pin.

Connect the remaining dissimilar color wire at '+'. Similarly connect for all other channels.

Notes:

1. When wiring RTDs, lead length and diameter must be chosen such that lead length are equal and that each lead exhibits no more than 10Ω resistance between the Paperless Recorder and the RTD (Pt-100).
2. For Input connections, high quality, low resistance contacts must be used which are suitable for dry operations.

3.3.1.1.2 Sensor wiring – Thermocouple/mV Input

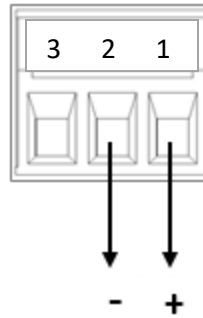


Figure 6- Sensor Wiring – Thermocouple/mV Input

Connect the 2-wires of sensor at '+' & '-' of sensor connector as shown in Figure 7.

3.3.1.1.2 Sensor wiring - 4-20mA / 0-20mA Input

Connect the '+' wire at pin-1 and '-' wire at pin-2 , connect 50 Ω in between '+' and '-' wires.

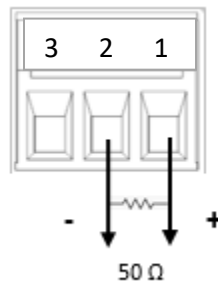


Figure A

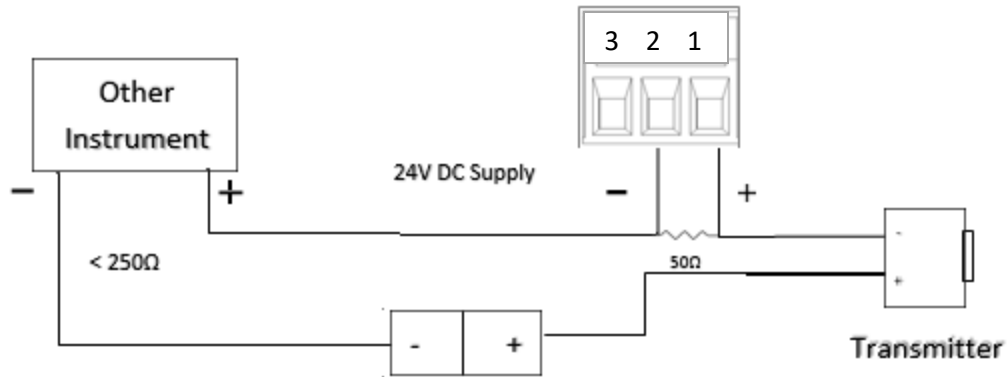


Figure B

Figure 7- Sensor Wiring - 4-20mA / 0-20mA Input

The connection for 4-20mA / 0-20mA input is shown in the figure 8(A). For Paperless Recorder, the shunt of 50Ω 0.1% is externally supplied. If you want to connect more than one instrument in series, than recorder should be placed in such a way that not more than 250Ω of load resistance is added in the loop after recorder as shown in Figure 8(B).

Note: - If 50Ω 0.1% shunt is used than the user should keep the multiplier ≈ 1.002 for 4-20mA which varies with the device.

3.3.1.1.3 Connecting Paperless Recorder with Transmitter and External Power Supply

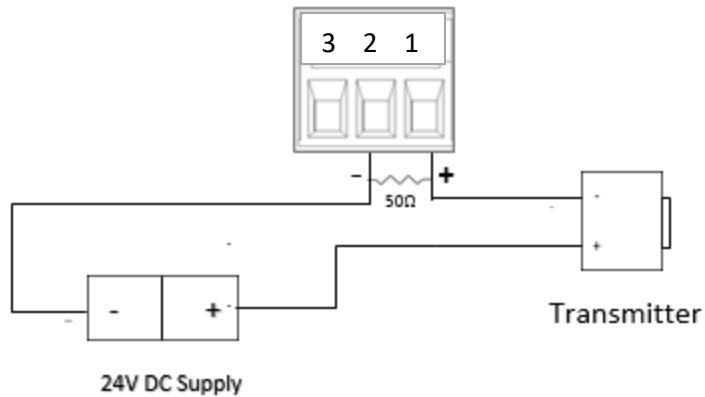


Figure 8- Connecting Paperless with Transmitter and External Power Supply

Connection of Paperless Recorder with Transmitter and External Power Supply is as shown in Figure 9. The shunt of 50Ω is externally supplied.

3.3.1.1.4 Sensor wiring – Volt Input

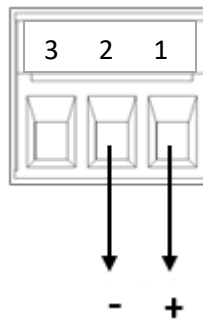
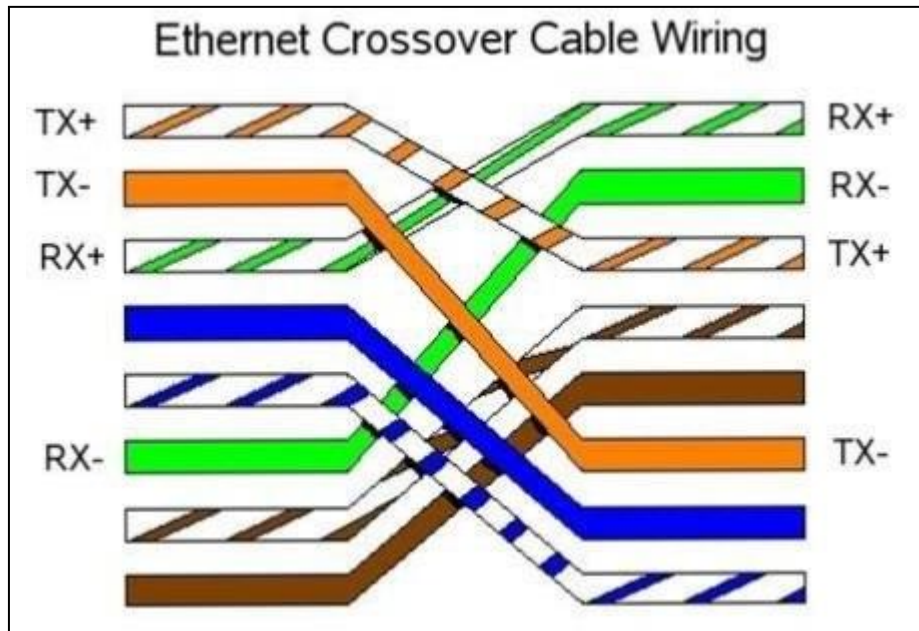


Figure 9- Sensor Wiring - Volt Input

The connection for Volt input is shown in the Figure 10.

3.3.2 Wiring diagram for PC interface

The Paperless Recorder can relate to PC using TCPIP Interface through GtekNet software developed by G-Tek. For this, RJ-45 connector is given on the back panel of the Paperless Recorder. A Crossover TCPIP Cable is required to connect Paperless Recorder to LAN. The cable wiring for crossover cable is shown in below figure.

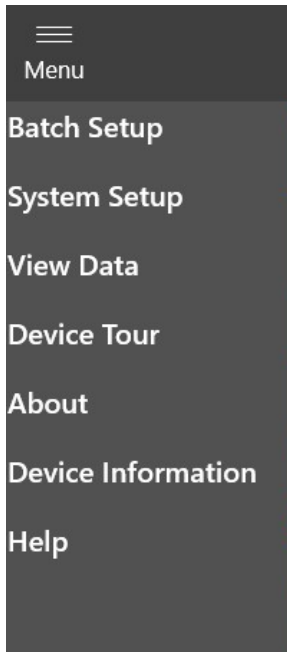


4 MAIN MENU

The main menu can be accessed by pressing the three dots on the upper right corner of the screen. By pressing,



the following options will be available.



Press any one of these options to view or set them. Main menu page header displays path of the current selection. For instance,

Figure 10 Main Menu



Figure 11- Menu Page Header

Here, to configure channel 1, from the main menu select Batch Setup. From Batch Setup select Channel Config and then the channel.

4.1 BATCH SETUP

4.1.1 Global Configuration

By modifying the global configuration, parameters of all the channels are changed accordingly.

Path: Main Menu -> Batch Setup -> Global Config

Table 1 Global Configuration parameters

Channel Thickness	Thickness of channel line in graph - max 10
Type of sensor	Choose sensor type connected from dropdown list
Offset	Channel Offset value (minimum -3276.8f and maximum 3276.7f)
Multiplier	Channel Multiplier value (minimum -3276.8f and maximum 3276.7f)
Range Low	Channel Range Low value (minimum -3276.8f and maximum 3276.7f)
Span	Channel Span value (minimum -3276.8f and maximum 3276.8f)
Unit	Channel unit - maximum length 10
Resolution	Select Resolution from 1, 0.1, 0.01,0.001 For example, if current data for channel 1 is 230.567887, the current data displayed for: Resolution 1, the current data displayed is 230 Resolution 0.1, current data displayed is 230.5 Resolution 0.01, current displayed is 230.56 Resolution 0.001, current displayed is 230.567

The screenshot shows a configuration window with the following parameters:

- Thickness: 2
- Sensor: RTD (Pt-100)
- Offset: 0
- Multiplier: 1
- Alarm High: 150
- Scale: None
- Range Low: 0
- Span: 100
- Unit: Dea C
- Resolution: 0.01
- Alarm Low: 10

Figure 12-Global Configuration Parameters

4.1.2 Channel Configuration

Path: Main Menu -> Batch Setup -> Channel Config -> Channel List

From channel list, select any channel to modify its channel configuration. Fill the appropriate information in the relevant field to modify channel configuration.

Table 2 Additional Channel Configuration parameters

Channel Number	Auto generated fixed number of channels
Channel Tag	User defined tag of channel (required field)
Channel color	Color of channel tab and line (Select a channel color from the available dropdown list)

Figure 13-Channel Configuration Parameters

Press the three dots on bottom right corner to get the following options:

Figure 14-Update Options

On clicking button “Update And Exit” which will update channel configuration to device and returns to channel list page.

On clicking button “Update And Next” which will update channel configuration to device and opens next channel Configuration page.

On clicking button “Update And Previous” which will update channel configuration to device and opens previous channel Configuration page.

Error messages:

If mandatory fields are left blank, error will be generated as below.

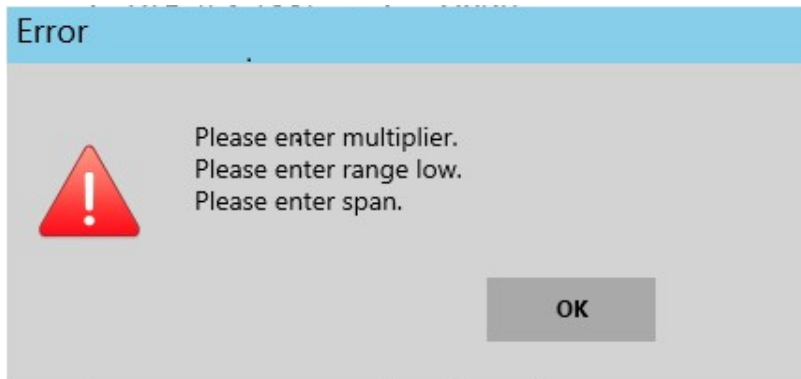


Figure 15- Blank field error

If incorrect values are entered, error message for invalid fields is displayed.

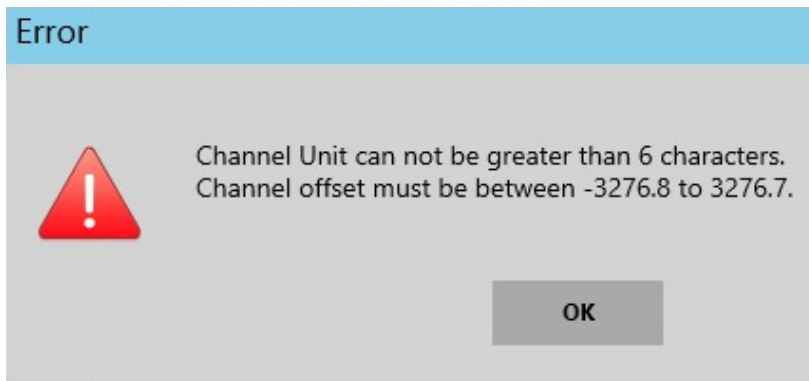


Figure 16- Invalid field entry error

Once all the fields are set properly then an alert message appears that ask to confirm the change in the channel settings.

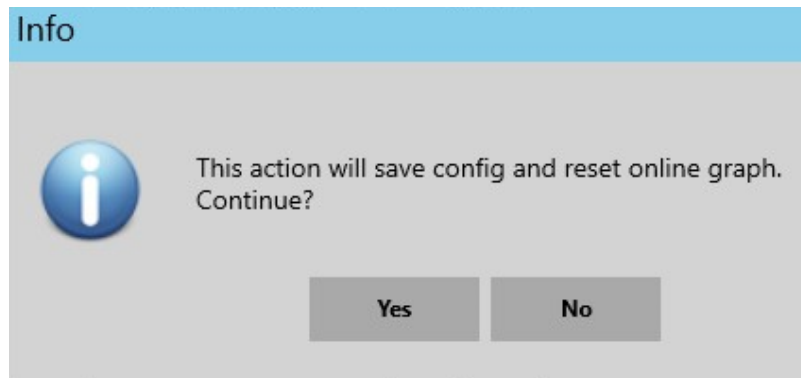


Figure 17 Confirmation message for channel configuration

Following message is displayed when channel configuration is updated successfully.

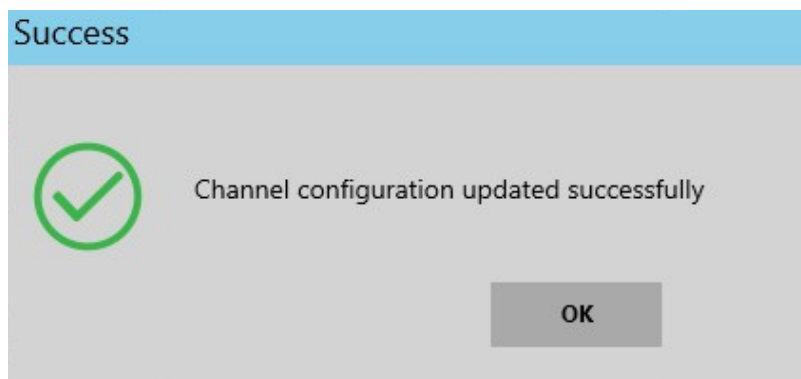


Figure 18- Channel Configuration Updated message

4.1.3 Output Configuration

Note: Current software version does not contain this feature. It will be available in future version.

4.1.4 Relay Configuration

A relay configuration provides 4 relays.

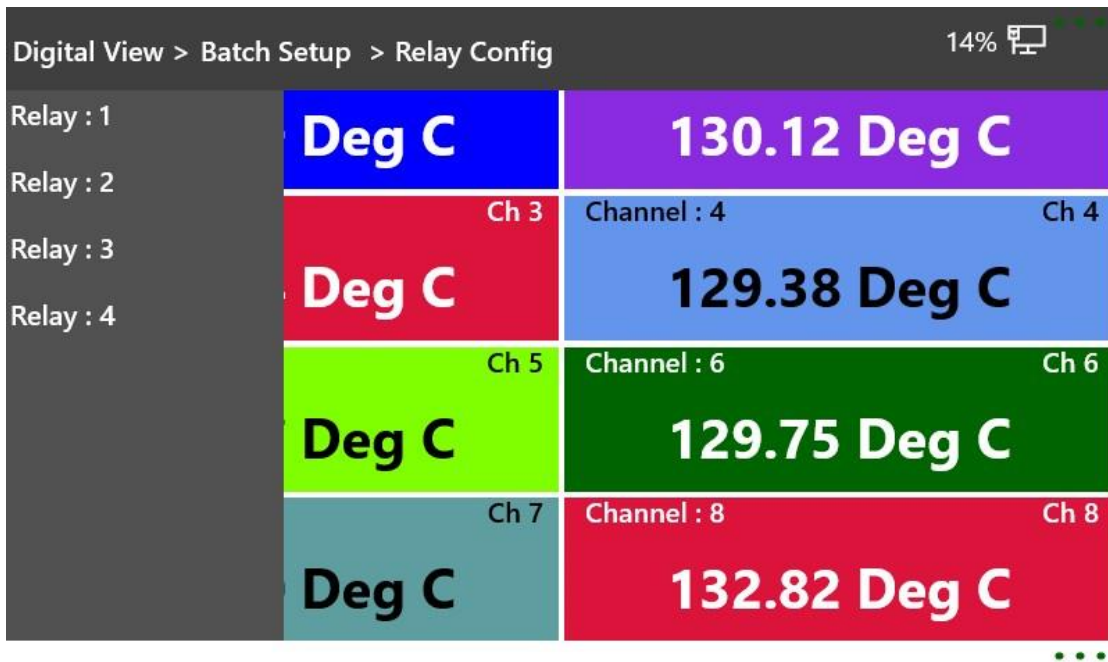


Figure 19 Relay Configuration

Each single relay can be configured for multiple channels. There are three type of relay configuration is available

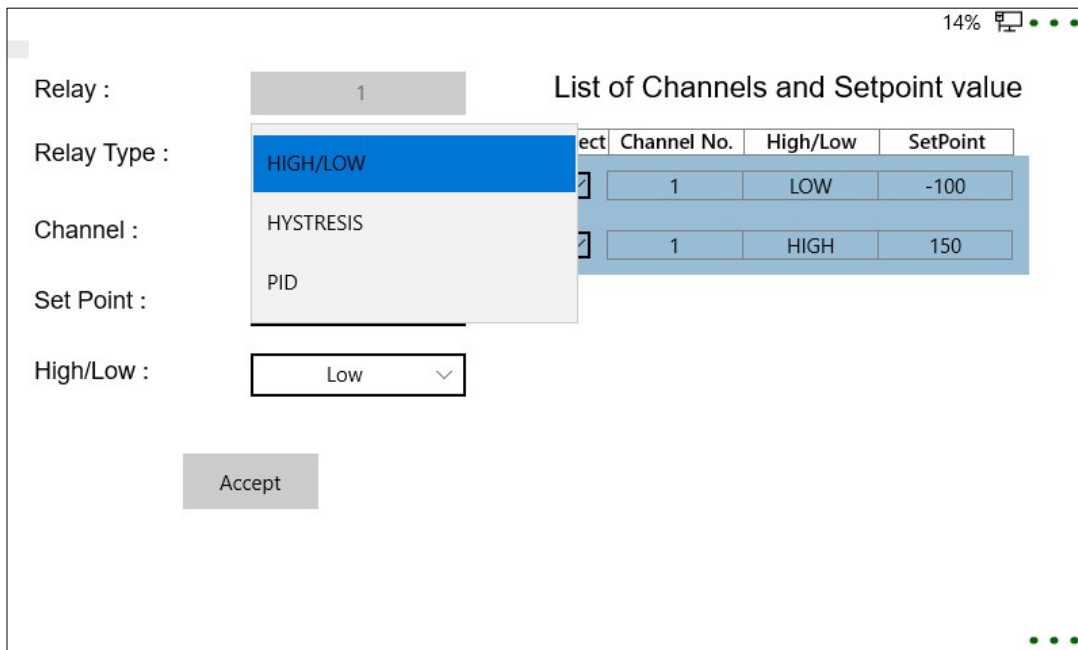


Figure 20 Relay Type

4.1.4.1 High/Low Relay

User can set High and Low value as per requirement. On pressing “Accept” button, the changed values can be saved individually for High/Low value in “List of Channels and setpoint value” Table.

Click on “Update and Next” for next relay configuration or click on “Update and previous” for previous relay configuration or click on “Update and Exit” to save the configuration for selected relay.

The screenshot displays a configuration interface for a High/Low Relay. On the left, there are five input fields: 'Relay' (value: 1), 'Relay Type' (value: HIGH/LOW), 'Channel' (value: CH: 1), 'Set Point' (value: -100), and 'High/Low' (value: Low). Below these fields is an 'Accept' button. On the right, a table titled 'List of Channels and Setpoint value' is shown. The table has four columns: 'Select', 'Channel No.', 'High/Low', and 'SetPoint'. Two rows are visible, both with checked checkboxes in the 'Select' column. The first row has '1' in 'Channel No.', 'LOW' in 'High/Low', and '-100' in 'SetPoint'. The second row has '1' in 'Channel No.', 'HIGH' in 'High/Low', and '150' in 'SetPoint'. The top right corner of the interface shows '14%' and three green dots. The bottom right corner shows three green dots.

Select	Channel No.	High/Low	SetPoint
<input checked="" type="checkbox"/>	1	LOW	-100
<input checked="" type="checkbox"/>	1	HIGH	150

Figure 21 High/Low Relay Configuration

4.1.4.2 Hysteresis Relay

Note: Current software version does not contain this feature.

4.1.4.3 PID Relay

Note: Current software version does not contain this feature.

4.1.5 Group

A group is a set of device channels which is useful when user wants to see the data in certain order or wants to compare different channels which are in different scanning order. Maximum 6 groups are available. These can neither be added or deleted but can only be modified while batch is not running.

Group is useful while configuring a new “Preconfigured” batch. By selecting group in a batch, the channels within that group will be added to the batch. Group wise batch data can be viewed either while the batch is running or after it has been stopped.

Groups selected within a current batch can be viewed on all current data pages.

Path: Menu->batch setup->Group

The screenshot shows a digital view interface for 'Batch Setup > Group'. It displays six groups of channels, each with a temperature reading. The interface includes a top navigation bar with 'Digital View > Batch Setup > Group' and a '10%' zoom level. The data is presented in a table-like structure with colored cells for each group and channel.

Group	Channel	Temperature
Group : 1	C	128.16 Deg C
Group : 2	Ch 4	Channel : 5
Group : 3	C	131.71 Deg C
Group : 4	Ch 7	Channel : 8
Group : 5	C	128.52 Deg C
Group : 6	Ch 10	Channel : 11

Additional channel data from the screenshot:

Channel	Temperature
Ch 5	128.75 Deg C
Ch 6	128.71 Deg C
Ch 8	130.15 Deg C
Ch 11	130.06 Deg C
Ch 12	128.48 Deg C

Figure 22- Group

Modify Group:

Select a group from “Group List” page. The above image shows list of groups. User can modify following group information.

Table 3 Modify Group parameters

Group name	Enter group name (maximum length is 10 characters)
Channels	Select channels (Orange color shows selected channel)

On clicking button “Update and Exit”, group information is updated and exit from the group menu

Group Name:

Select Channel:

CH : 1	CH : 2	CH : 3	CH : 4
CH : 5	CH : 6	CH : 7	CH : 8
CH : 9	CH : 10	CH : 11	CH : 12
CH : 13	CH : 14	CH : 15	CH : 16
CH : 17	CH : 18	CH : 19	CH : 20
CH : 21	CH : 22	CH : 23	CH : 24

Update And Previous Update And Exit Update And Next ...

Figure 23- Modifying Group

On clicking button “Update and Next”, group information is updated, and next group information page is opened.

On clicking button “Update and Previous”, group information is updated and previous group information page is opened.

If mandatory fields are left blank, an error message will be displayed.

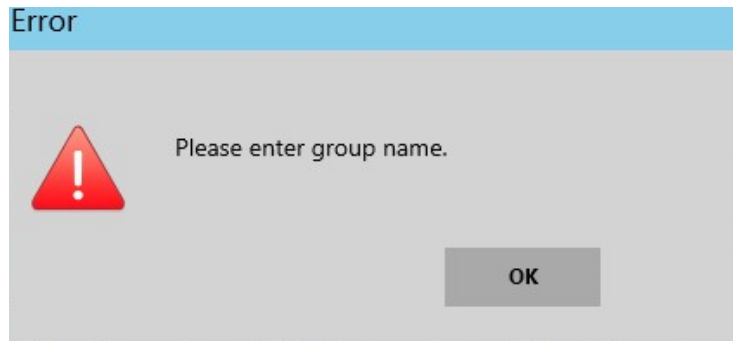


Figure 24- Mandatory fields blank error

If incorrect values are entered, error messages for invalid fields are displayed.

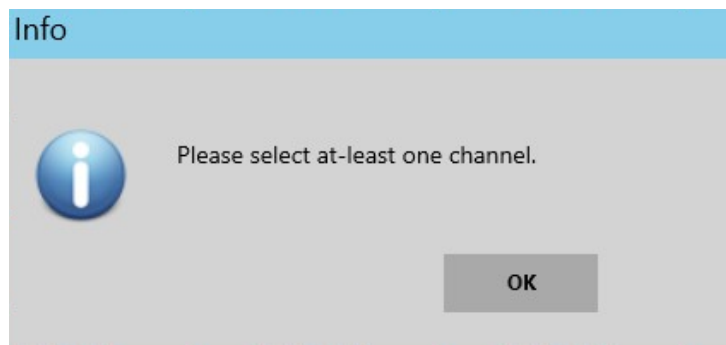


Figure 25- Invalid field value entered error

Following message is displayed when group information is updated successfully.

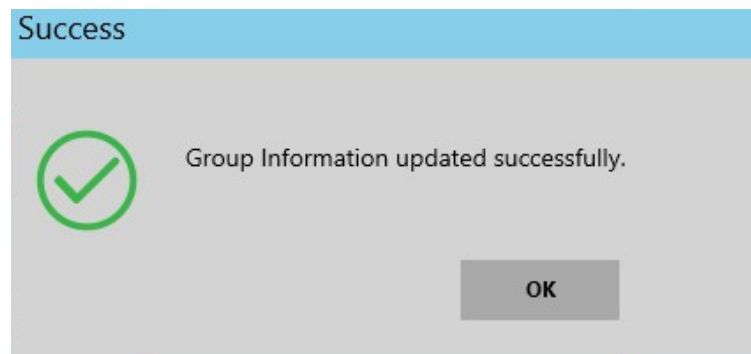


Figure 26- Group Information Updated Successfully

4.1.6 Create Batch

From “Create Batch” page, either manual batch or preconfigured batch can be started.

Table 4 Create Batch parameters

Column Name	Description
Batch Name	Name of the Batch (allows maximum 50 characters)
Store Interval (Seconds)	Time interval at which Batch readings are stored -minimum 5 seconds and maximum 18 hours
Trend Interval (Seconds)	Trend interval of Batch. Trend interval must be within Store Interval and maximum trend interval [Store Interval * maximum number of readings in trend]
No. of readings in Trend	Number of readings in trend -minimum 2 and maximum 500
Batch Type	Select batch type - Manual or Preconfigured
Start Date Time	For “Preconfigured” batch type, select time to start Batch. Batch start time must be less than batch stop time and must be greater than current time + 5 minutes.
Stop Date Time	Stop time of Batch. Batch stop time must be greater than the Batch start time.

In **Manual** batch type after saving the above configurations, batch can be started manually at any time by pressing “Start” from the Digital View or Graph View.

Batch Name: Batch Type:

Store Interval Sec:

Chart Speed :

Trend Interval Sec :

Select	Group No.	Group Name	Group Channels
<input type="checkbox"/>	1	g1	1, 2, 3, 4
<input type="checkbox"/>	2	g2	1, 2, 3, 4
<input type="checkbox"/>	3	g3	1, 2, 3, 4
<input type="checkbox"/>	4	g4	1, 2, 3, 4

Figure 27 Manual Batch config

To setup **preconfigured batch**, fill batch information and click on button setup batch. It will start batch on the set Start time and store data at every store interval. If preconfigured batch is set for **Recurring mode** than the batch will start and stop every interval mentioned in Start and Stop time.

Batch Name: Batch Type:

Store Interval Sec: Start Time : :

Chart Speed: Stop Time : :

Trend Interval Sec : Recurring Batch : No Yes

Select	Group No.	Group Name	Group Channels
<input checked="" type="checkbox"/>	1	g1	1, 2, 3, 4, 5, 6, 7, 8
<input type="checkbox"/>	2	g2	8
<input type="checkbox"/>	3	a3	25. 26. 27. 28. 29. 30. 31. 32

Figure 28 Preconfigured batch

Fill the appropriate information in the relevant field to add new batch.

Notes:

- If batch is running when SD card memory is less than 500 MB and if it is stopped, new batch cannot be started.
- If batch is preconfigured and user starts a new manual batch, the preconfigured batch will be overridden by new manual batch and it will be discarded.

Error messages:

If mandatory fields are left blank, an error message will be generated.

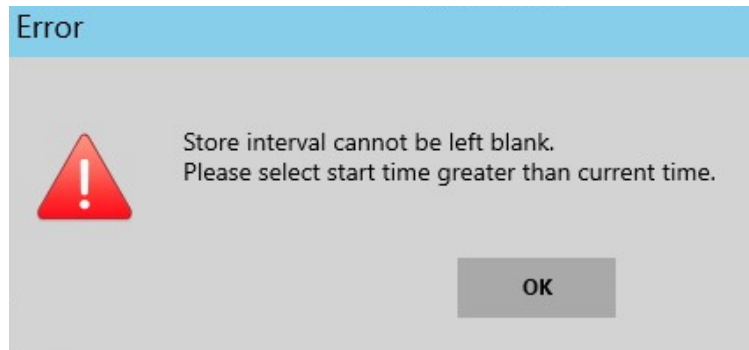


Figure 29- Create Batch Error message for blank fields

If incorrect values are entered, error messages for invalid fields are displayed.

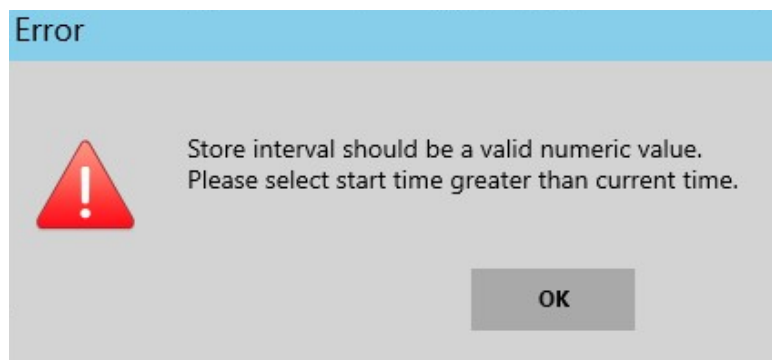


Figure 30- Create Batch Error for invalid fields entered

4.2 SYSTEM SETUP

System Setup allows to modify system level setting of paperless device. It allows to

1. Change system language,
2. Take system backup,
3. Restore device to factory calibration
4. Perform channel calibration,
5. Modify communication parameters,
6. Set display brightness,
7. Upgrade software

4.2.1 Locale

Paperless Recorder can be used in 6 different languages -English, Hindi, Gujarati, French, German and Portuguese. System language as well as clock (RTC – real time clock) can be changed from “Locale”.

Path: Menu->System Setup-> Locale

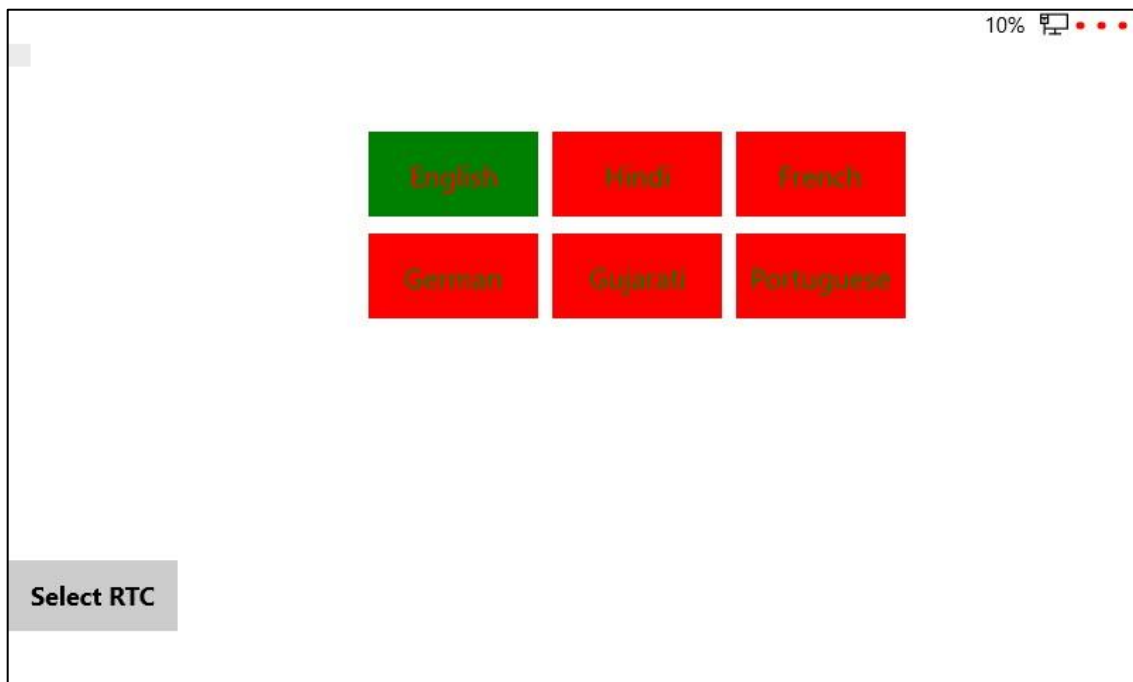


Figure 31- Locale

On pressing button “French”, system language is changed to French and the following message is displayed.

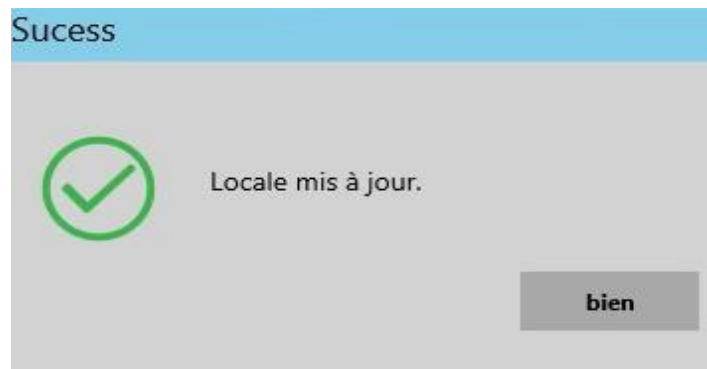


Figure 32- System language successfully changed to French

On clicking button “Select RTC”, RTC (Real Time Clock) i.e., time, date and time zone of the device can be changed. On clicking button “Set RTC”, it allows to update RTC.

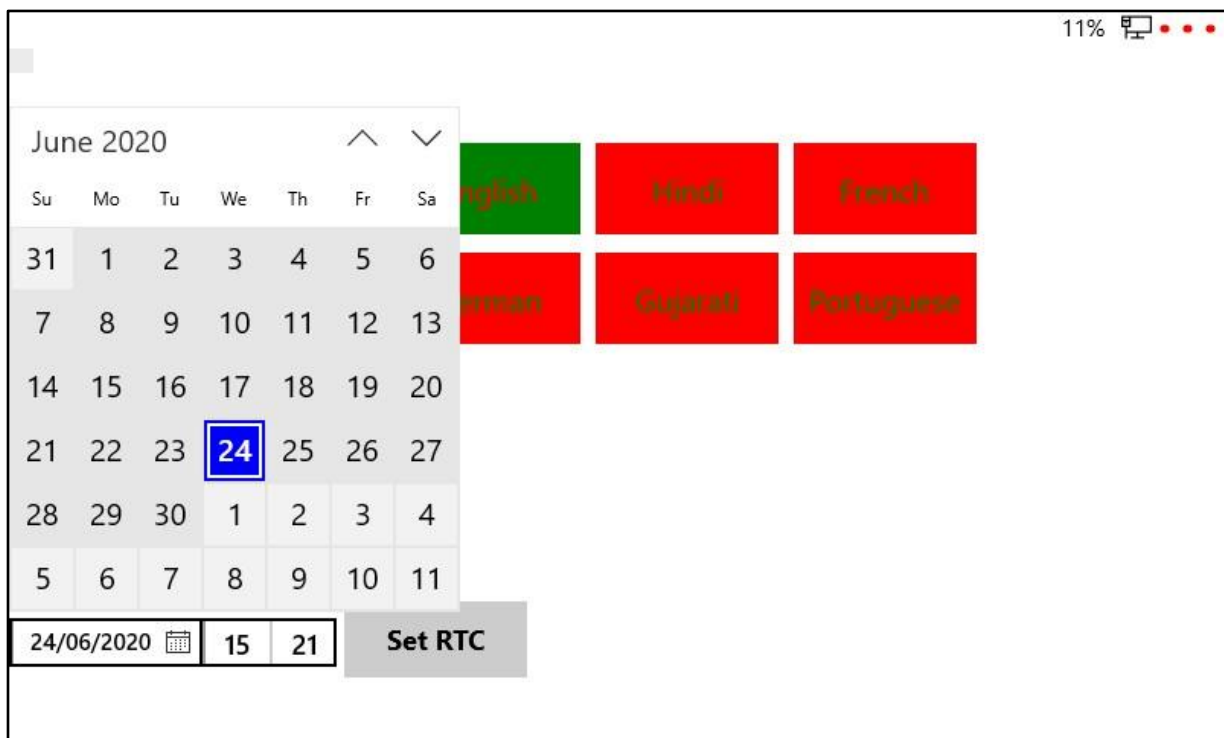


Figure 33 -Set System Clock

4.2.2 Back / Restore

User can take archive file backup of historical data of batch to USB with file extension “.arc”

Path: Menu->System Setup->Backup/ Restore

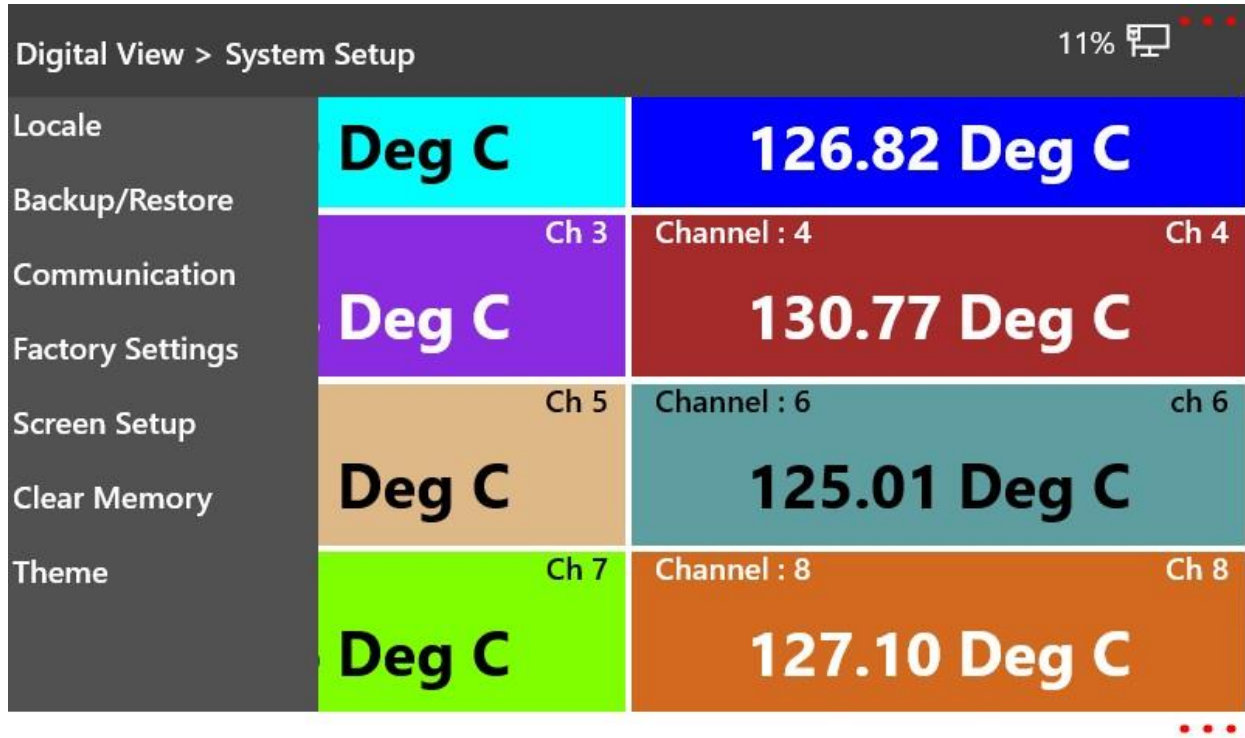
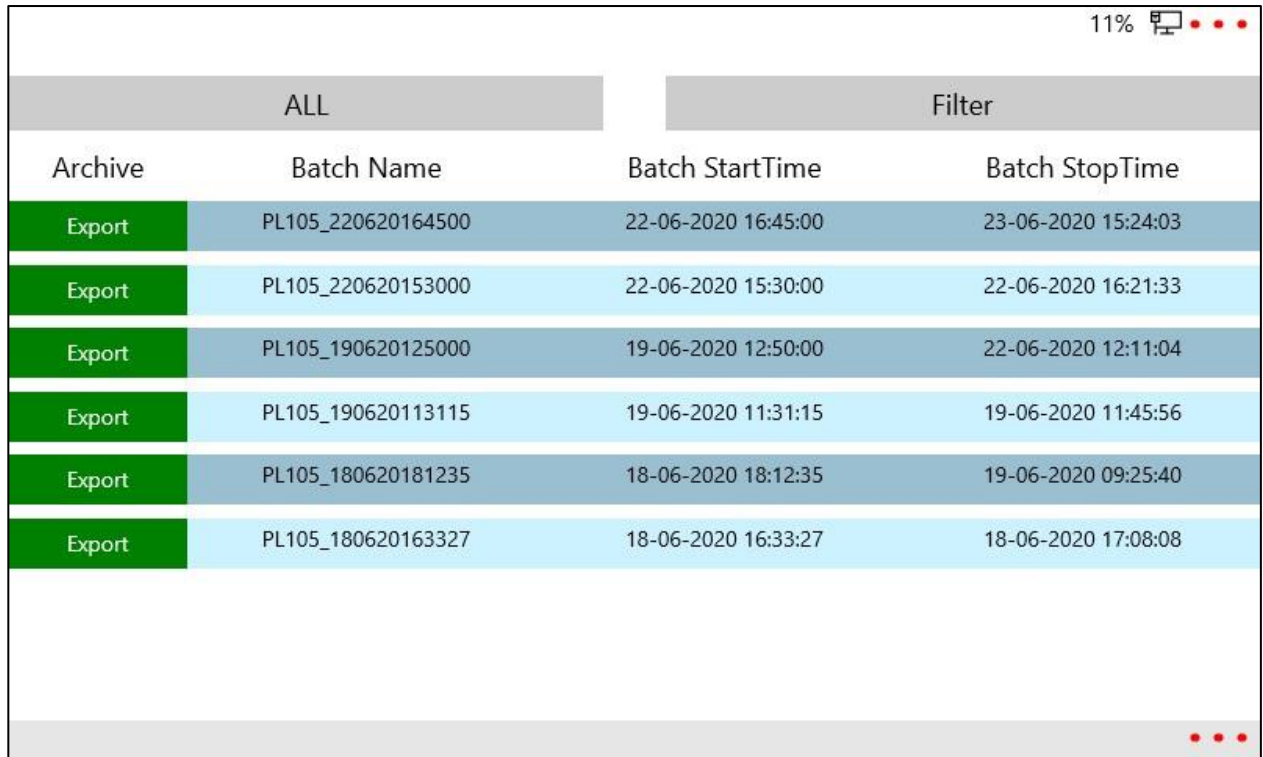


Figure 34 -Backup / Restore menu options

4.2.3.1 Bach Backup

On batch Backup/Restore page, it displays all historical batches with batch name, batch start and batch stop time.



Archive	Batch Name	Batch StartTime	Batch StopTime
Export	PL105_220620164500	22-06-2020 16:45:00	23-06-2020 15:24:03
Export	PL105_220620153000	22-06-2020 15:30:00	22-06-2020 16:21:33
Export	PL105_190620125000	19-06-2020 12:50:00	22-06-2020 12:11:04
Export	PL105_190620113115	19-06-2020 11:31:15	19-06-2020 11:45:56
Export	PL105_180620181235	18-06-2020 18:12:35	19-06-2020 09:25:40
Export	PL105_180620163327	18-06-2020 16:33:27	18-06-2020 17:08:08

Figure 35- Batch details displayed on Backup / Restore page

On pressing button “Export”, user can export historical batch data in archive format to USB device. In case USB device is not connected, the following message is displayed.



Figure 36- Backup / Restore Error - USB Stick not available

4.2.3.2 Download Logs

To download the logs, attach USB pen drive with the device. All the logs regarding paperless activities will export to USB pen drive.

Once all the logs will be exported to pen drive, the message will appear as follows:

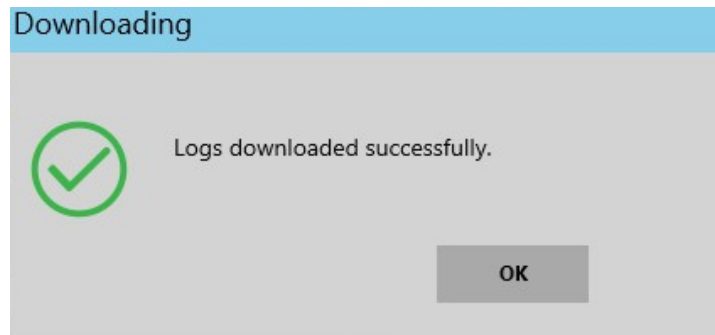


Figure 37 Log downloaded successfully

If Pen drive is not attached, then error message will appear as follow:

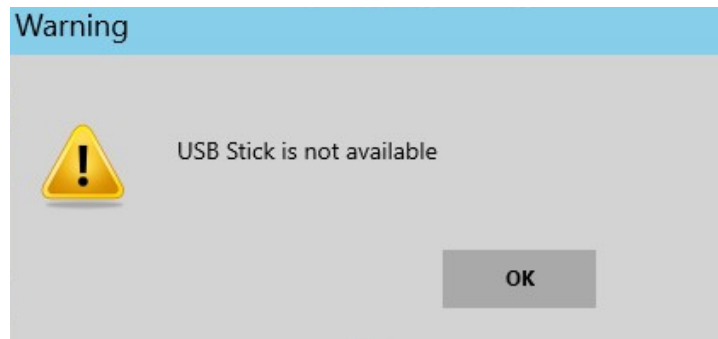


Figure 38 Download log error message

4.2.3.3 Configuration Backup

User can take backup of the set configuration by this menu. Once USB Pen drive is attached to the Paperless device and then press “**Configuration Backup**”, the set configuration will be exported to the USB pen drive in the form of folder named as “**Configuration File**”.

Once the backup is exported successfully, then below message will appear:

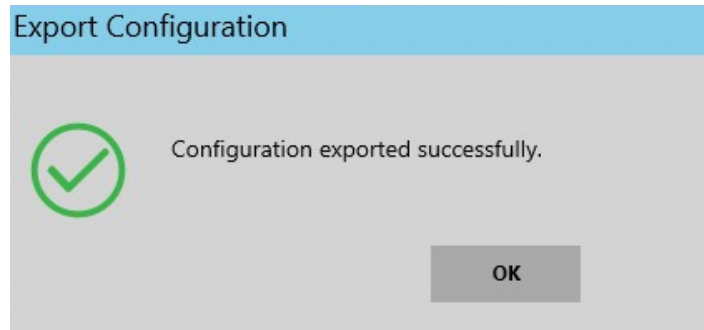


Figure 39 Configuration Backup

If the USB pen drive is not attached, then following message will appear:

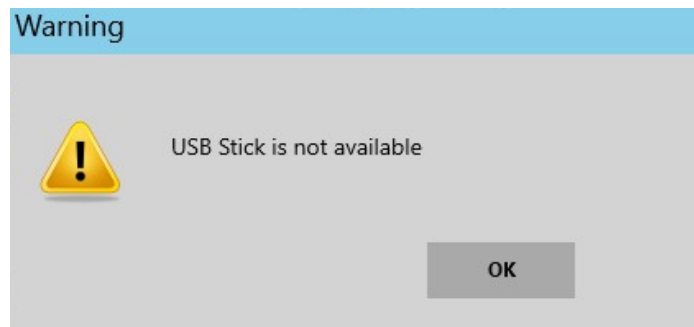


Figure 40 Configuration backup error message

4.2.3.3 Configuration Restore

User can restore the previously set configuration, if backup is taken. To restore the configuration, attach USB Pen drive where the “**Configuration File**” is available and press the “**Configuration Restore**” on the paperless device.

First the message appears, asking for the confirmation as follow:

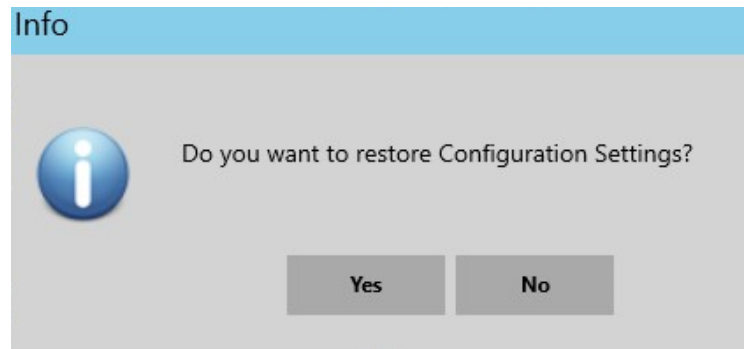


Figure 41 Configuration Restore

If the USB pen drive is not attached, then following message will appear:



Figure 42 Configuration Restore error message

4.2.3.4 Database Backup

User can take backup for the whole database of the device from this menu. Attach the USB pen drive to the device, press “Database Backup”. Whole database will be exported to the USB pen drive in the form of folder named as “**Database Backup**”.

Once database is exported to the USB pen drive successfully, then message appears as follow:

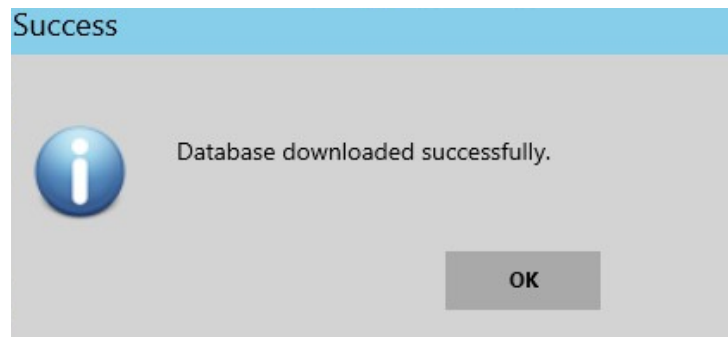


Figure 43 Database Backup

If the USB pen drive is not attached, then following message will appear:



Figure 44 Database backup error message

4.2.3.5 Database Restore

User can restore older database if database backup is taken. To restore the database, attach the USB pen drive where “**Database Backup**” folder is available. Press “**Database Restore**” on the paperless device; the following message will appear:

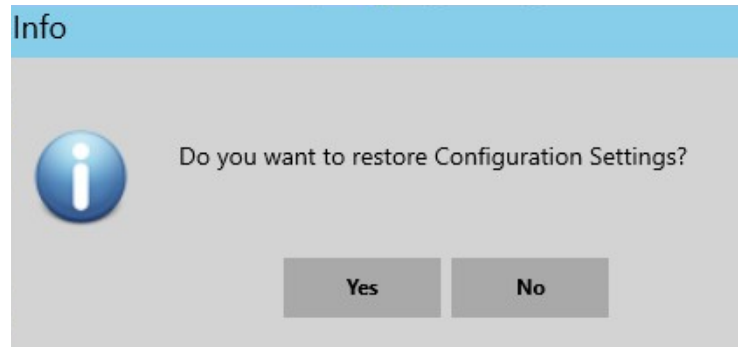


Figure 45 Database Restore

If the USB pen drive is not attached, then following message will appear:

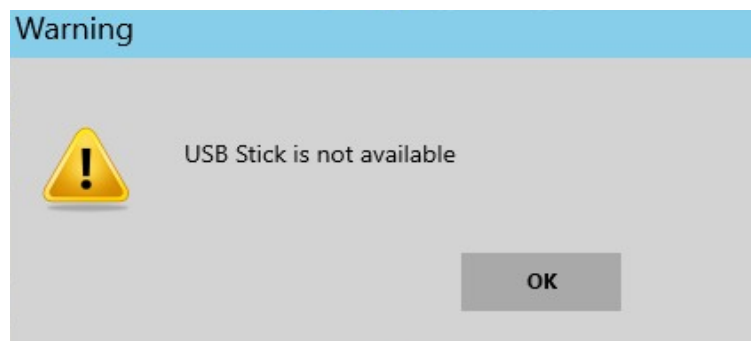


Figure 46 Database restore error message

4.2.3 Communication

Press on the text block to modify the following network and communication parameters:

Table 5 Communication Parameters

Host Name	Name of Host - Maximum 15 characters (Required)
MAC Address	MAC Address of Device (Required)
DHCP Enable	Yes – to enable and No – to disable
IP Address	Enter valid IP Address of Device (e.g. 192.168.0.34) (required)
Port Number	Port Number (Numeric value only) (Required)
Device Address	Enter a valid Device Address (Required)
Gateway	Enter a valid Gateway (should not be null) (Required)
Subnet Mask	Enter a valid Subnet Mask (should not be null) (Required)
Primary DNS	Enter a valid Primary DNS (should not be null) (Required)
Secondary DNS	Enter a valid Secondary DNS (should not be null) (Required)

The screenshot shows a network configuration interface with the following parameters and values:

- Type: **TCPIP** (selected), ASCII, RTU
- Device Address: 96
- Host Name: paperless
- Gateway: 192.168.1.1
- DHCP Enable: **YES** (selected), NO
- Subnet Mask: 255.255.255.0
- IP Address: 192.168.1.105
- Primary DNS: 8.8.8.8
- Port Number: 502
- Secondary DNS: 8.8.4.4
- MAC Address: B8-27-EB-6B-ED-99

Figure 47 -Network Parameters

If mandatory fields are left blank, the following error will be generated.

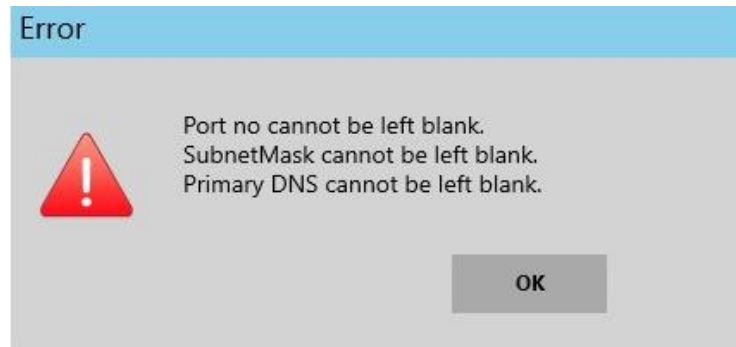


Figure 48- Communication configuration error for blank fields

If incorrect values are entered, error messages for invalid fields are displayed.

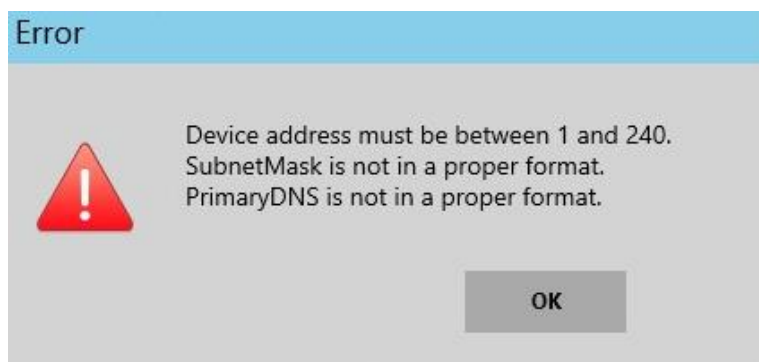


Figure 49- Communication Configuration error for invalid field values entered

Following message is displayed when Communication configuration is updated successfully.

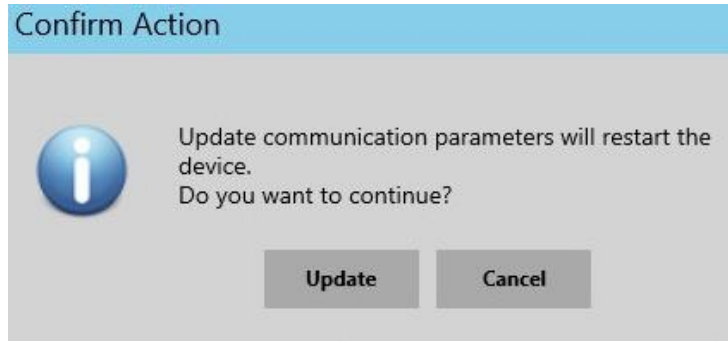


Figure 50- Message - Communication Parameters updated successfully

4.2.4 Factory Setting

From this menu, user can calibrate channel, touch, restore device, restore configuration and update software.

Path: Menu->System Setup-> Factory Setting

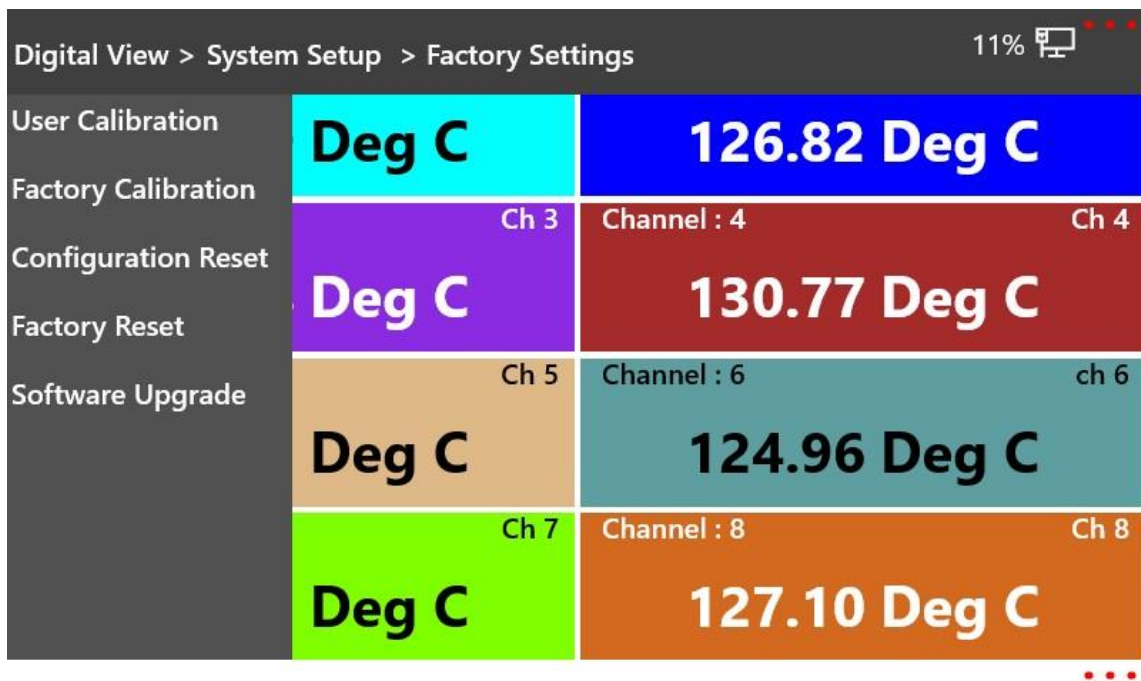


Figure 51- Factory Settings Menu

4.2.4.1 User Calibration

If unable to get satisfactory readings, User can perform calibration through “User Calibration” menu:

4.2.4.1.1 RTD Calibration

For 3 wire RTD,

Connect the red wire of RTD in pin 1 of the connector. Similarly connect the first white wire of RTD in pin 2. Connect the second white wire in pin 3 as shown in figure.

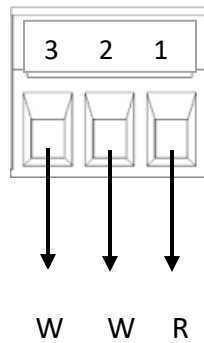


Figure 52- Connection for 3 wire RTD calibration

For 4 wire RTD,

Connect both the red wires of RTD in pin 1 of the connector. Similarly, connect one of the white wires in pin 2 and the other in pin 3.

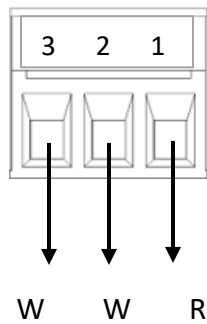


Figure 53- Connection for 4 wire RTD calibration

To perform the calibration for RTD for **respected card select 1st channel** of that card as calibrate channel, click on **“RTD”** and apply input as per shown in the message below and click on **“next”** button:

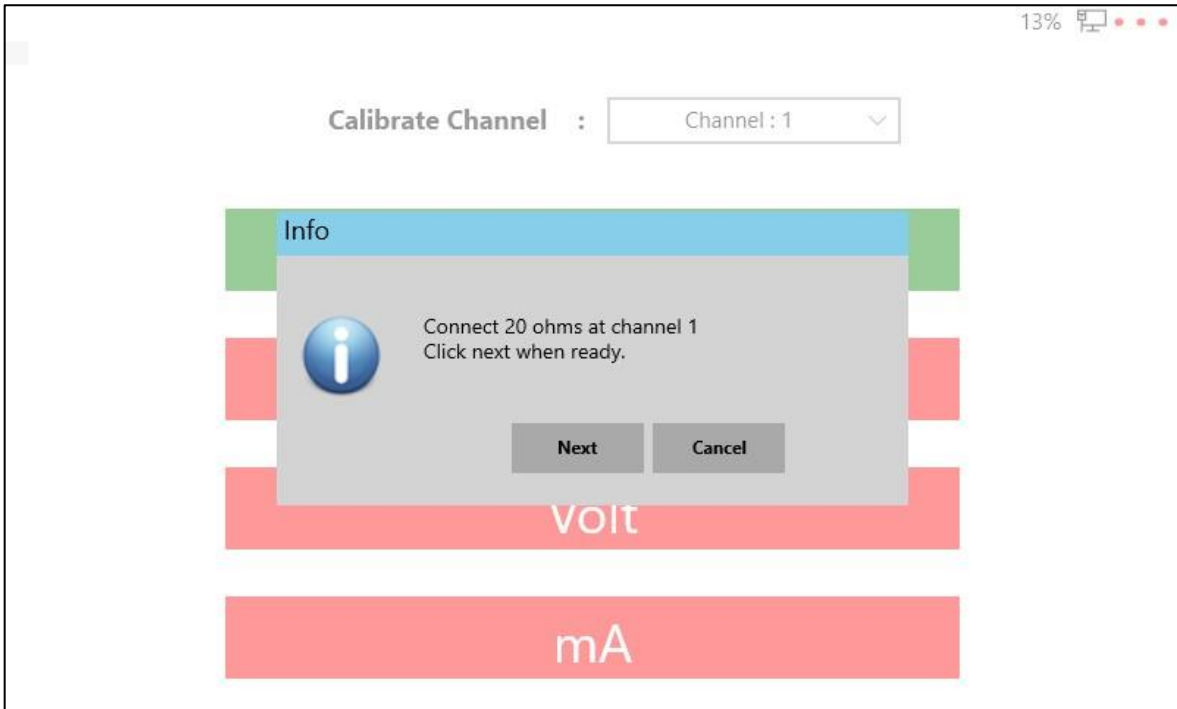


Figure 54 RTD Calibration 20 ohm

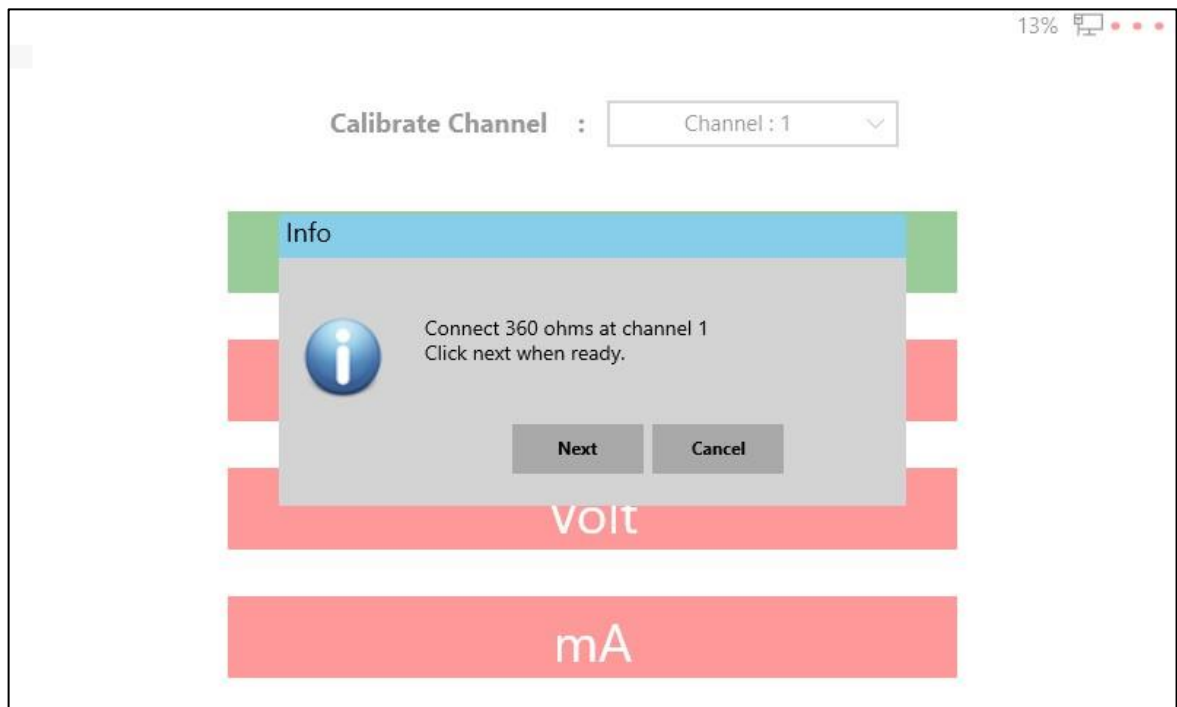


Figure 55 RTD Calibration 360 ohm

If an invalid value is applied, then the error message will appear as follow:

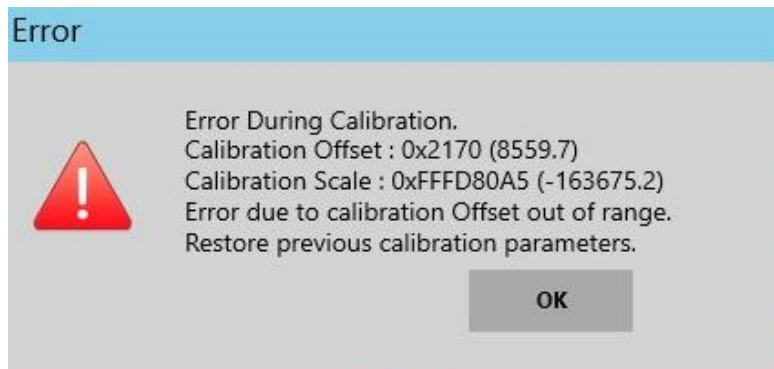


Figure 56 Calibration error message for RTD

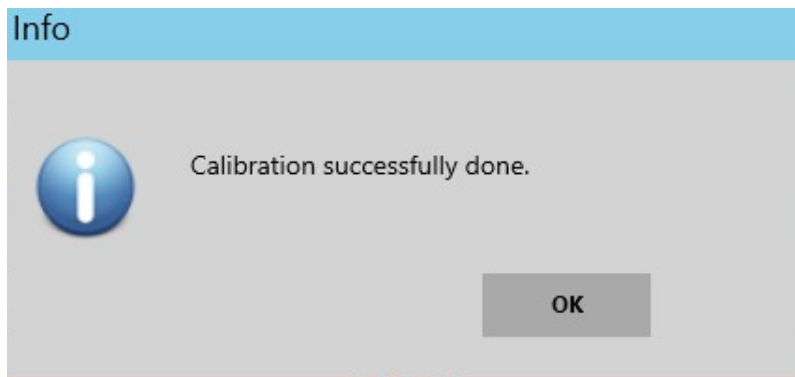


Figure 57 Calibration successful for RTD

4.2.4.1.2 mVolt Calibration

Connect the 2-wires of sensor at '+' (pin-1 of the connector) & '-' (pin-2 of the connector) of sensor connector as shown in below figure.

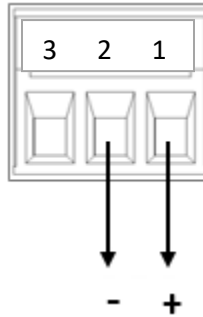


Figure 58 -Connection for mVolt Calibration

To perform the calibration for **thermocouple** for **respected card select 1st channel** of that card as calibrate channel, click on “mVolt” and apply input as per shown in the message below and click on “next” button:

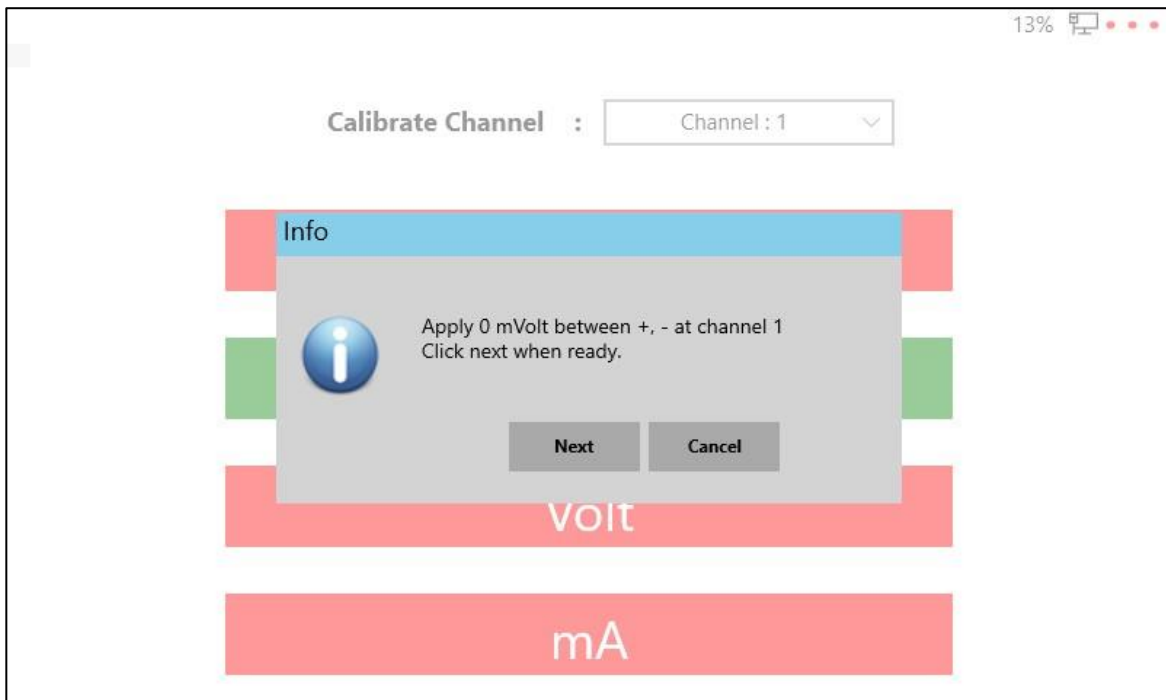


Figure 59 Thermocouple 0 mV

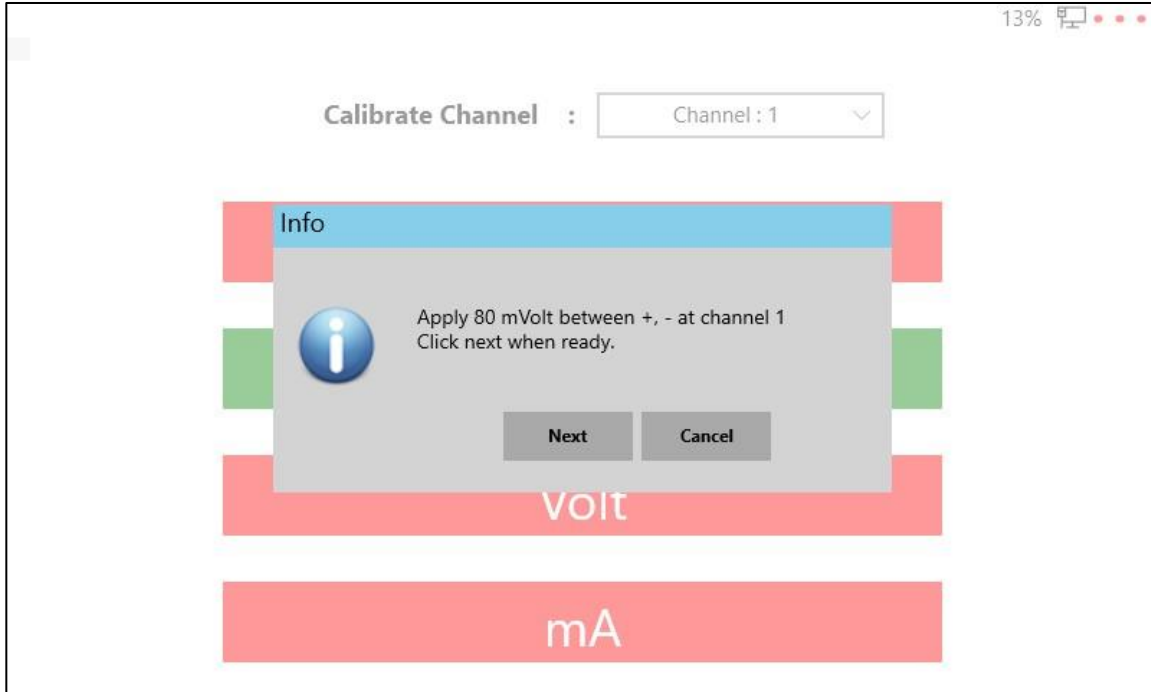


Figure 60 Thermocouple 80 mV

If invalid input value is applied, then following error message will appear:

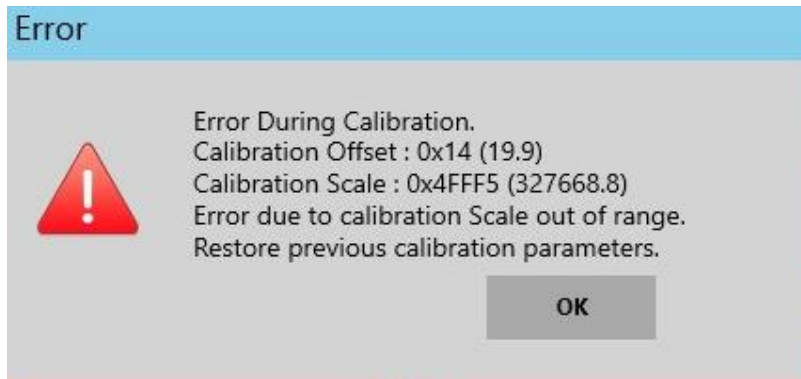


Figure 61 Calibration error message for mVolt

On successful calibration following message will appear:

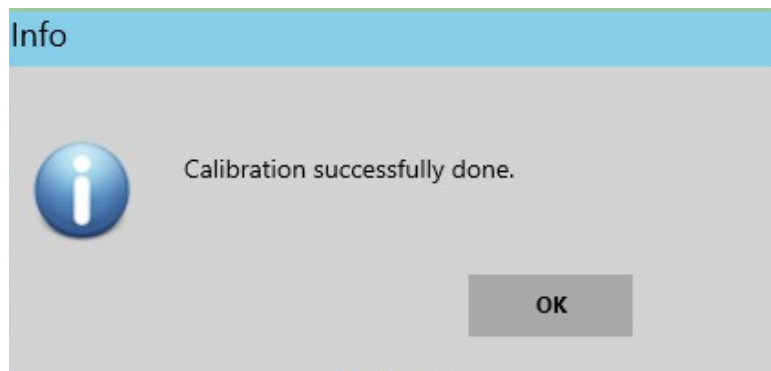


Figure 62 Calibration Successful for mVolt

4.2.4.1.3 Volt Calibration

Connect positive (+ve) terminal in 1st pin of the connector and negative (-ve) terminal in 2nd pin of the connector.

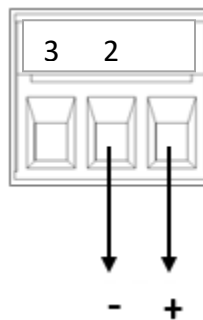


Figure 63 -Connection for Volt calibration

To perform the calibration for **Voltage** for **respected card select 1st channel** of that card as calibrate channel, click on **“Volt”** and apply input as per shown in the message below and click on **“next”** button:

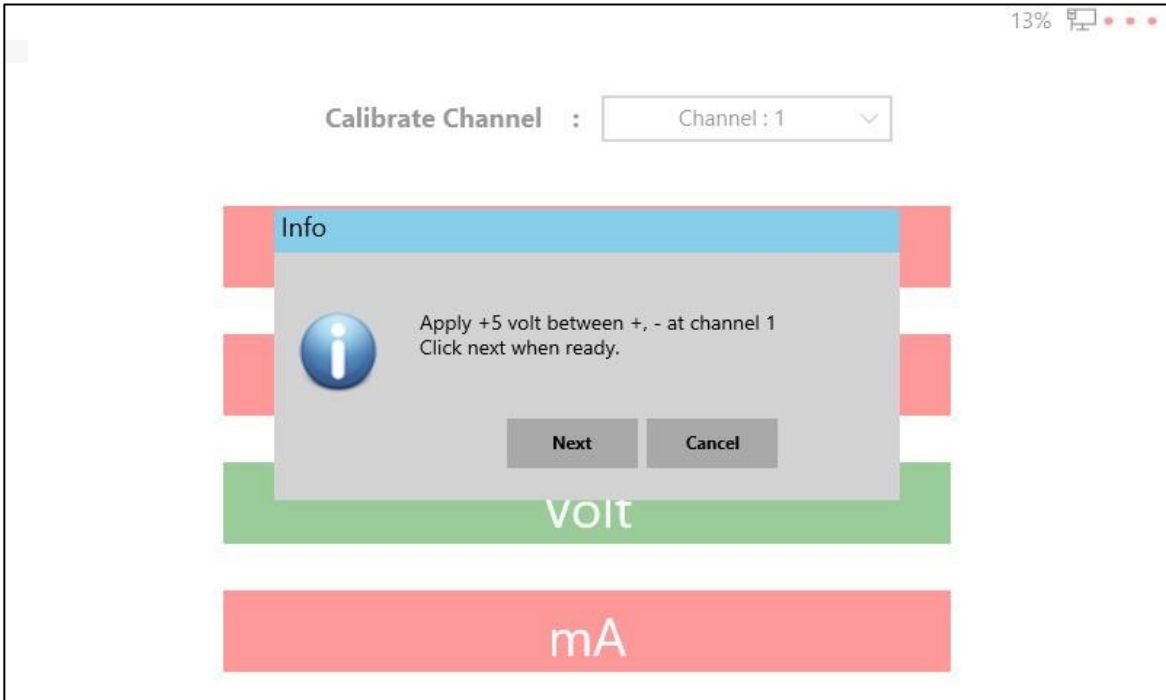


Figure 64 Volt +5 V

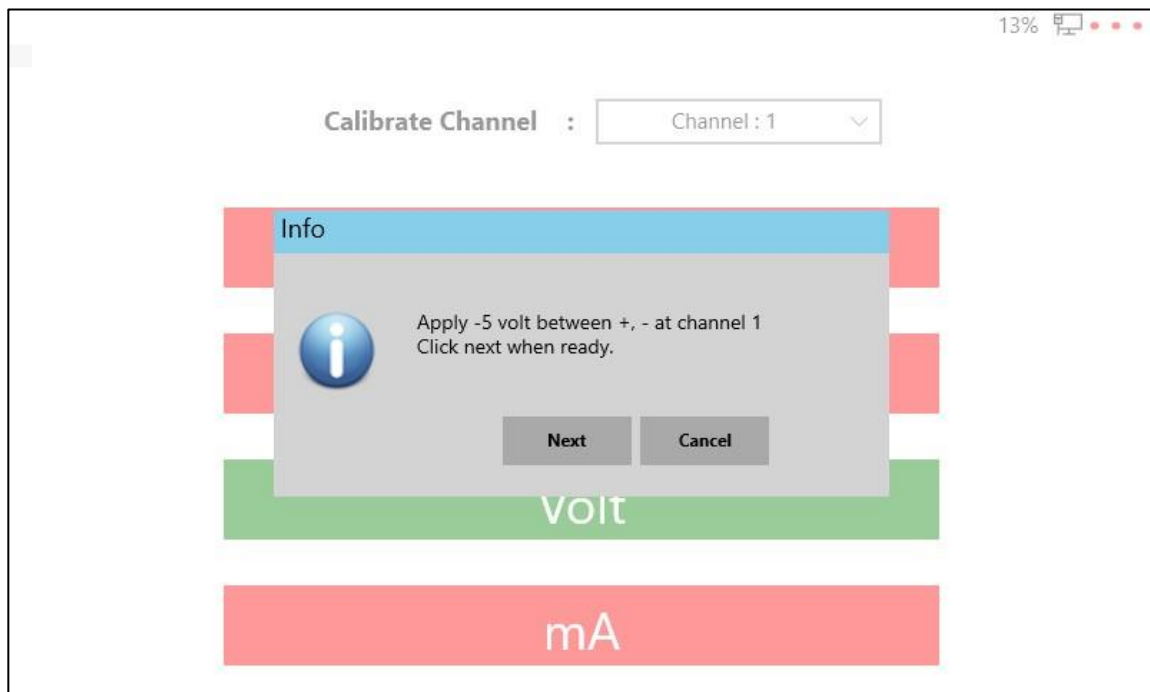


Figure 65 Volt -5 V

If invalid input value is applied, then following error message will appear:

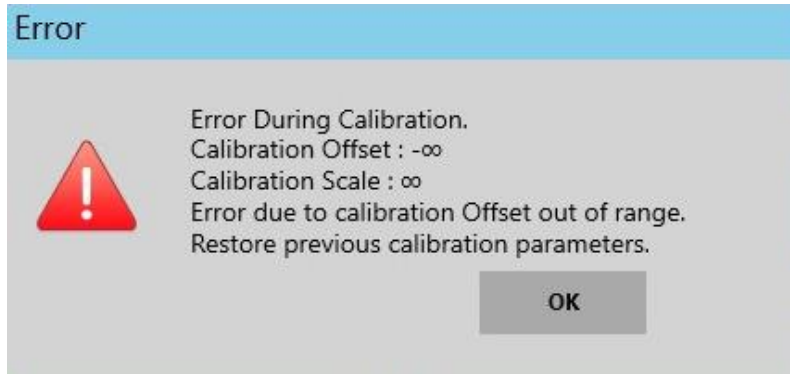


Figure 66 Error message for volt calibration

On successful calibration following message will appear:

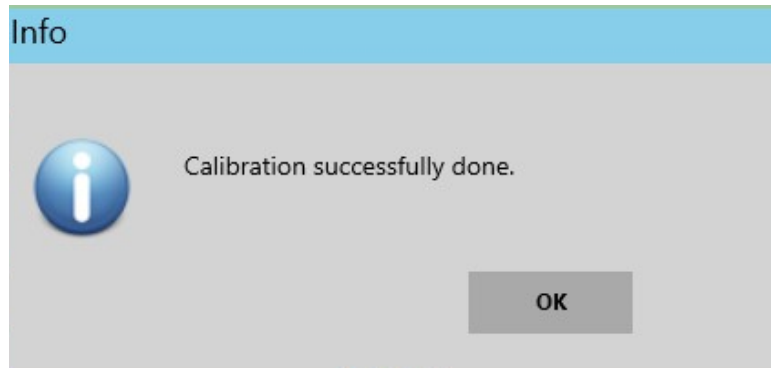


Figure 67 Calibration successful for Volt

4.2.4.1.4 mA Calibration

Connect positive (+ve) terminal in 1st pin of the connector and negative (-ve) terminal in 2nd pin of the connector.

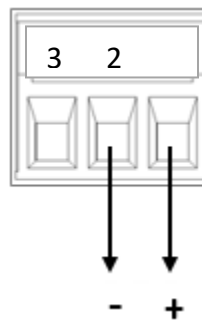


Figure 68 Connection for mA calibration

To perform the calibration for **mAmp** for **respected card select 1st channel** of that card as calibrate channel, click on “**mA**” and apply input as per shown in the message below and click on “**next**” button:

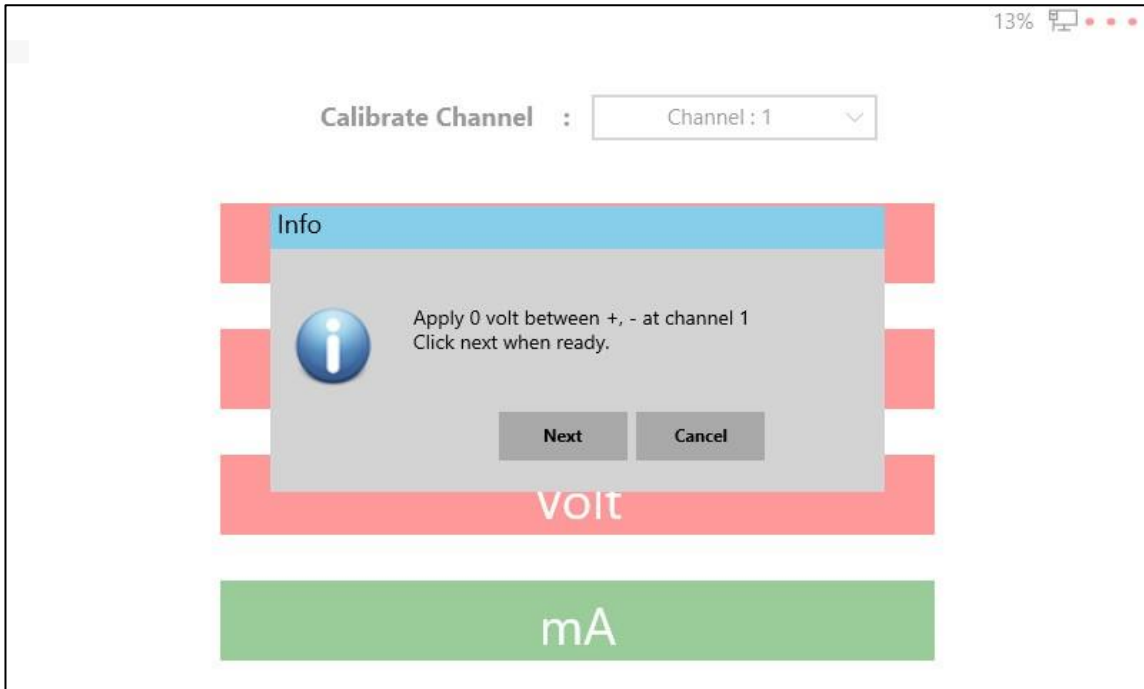


Figure 69 mA 0 Volt

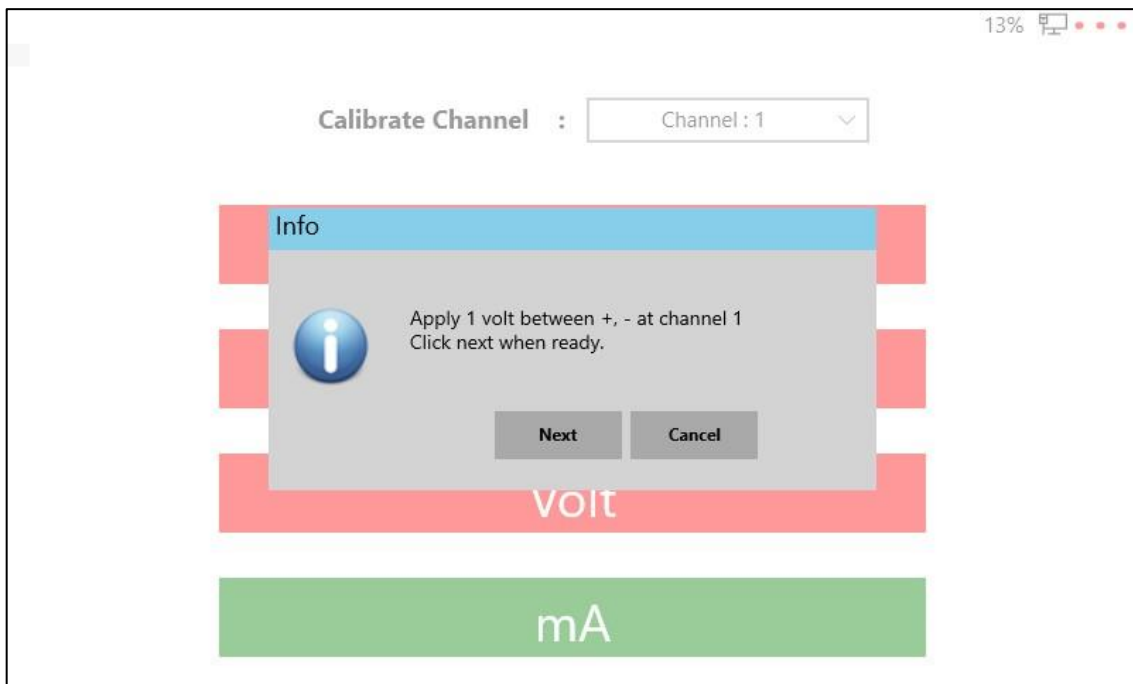


Figure 70 mA 1 Volt

If invalid input value is applied, then following error message will appear:

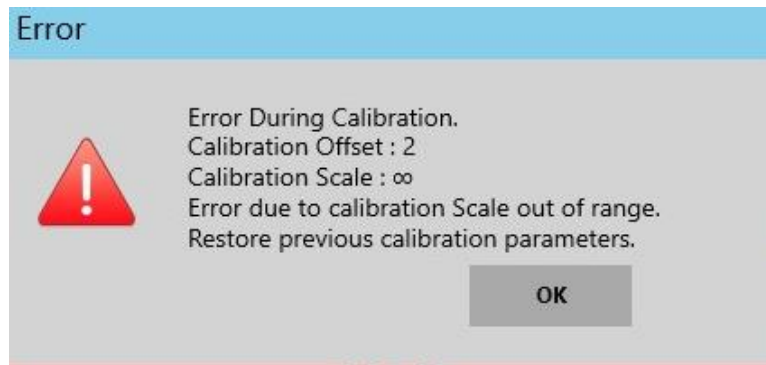


Figure 71 Error message for mAmp calibration

On successful calibration following message will appear:

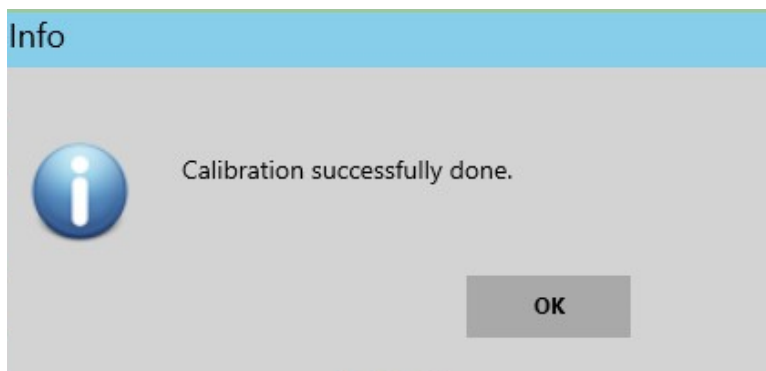


Figure 72 Calibration successful for mAmp

4.2.4.2 Factory Calibration

Device calibration parameters set by factory. User can restore the device to these factory settings.

4.2.4.3 Configuration Reset

Configuration reset execution will reset all the channel configuration to its default value.

4.2.4.4 Factory Reset

Factory configurations are wiped off.

4.2.4.5 Software Upgrade



Note: Current software version does not contain this feature. It will be available in future version.

4.2.5 Screen Setup

Note: Current software version does not contain this feature. It will be available in future version.

4.2.6 Clear Memory

User can clear the memory of the device from this menu. Press clear memory it will ask the username and password.

11%  

Channel : 1 Ch 1 | Channel : 2 Ch 2

User Name :

Password :

4
6
8

Figure 73 Clear Memory

Add **Admin** as username and **admin@123** as password

If wrong password is entered, then following message will appear:

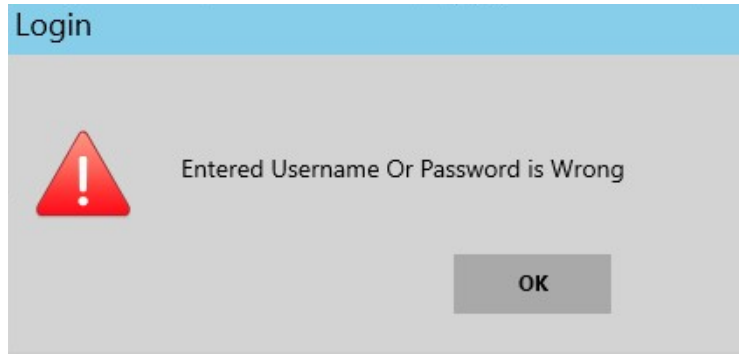


Figure 74 Wrong password error message

On entering proper password, following message will appear for confirmation:

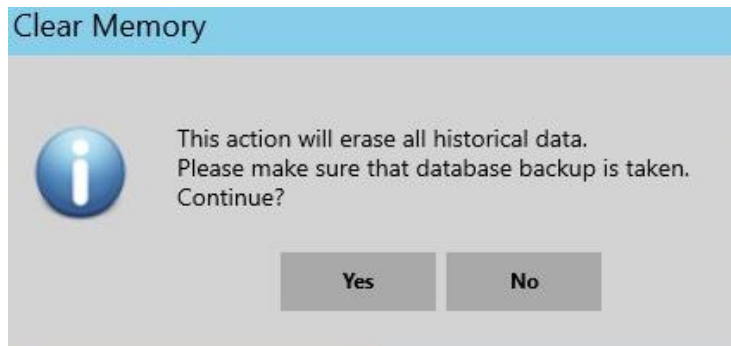


Figure 75 Confirmation message for clear memory

On pressing "Yes", again another message will appear for final confirmation as follow:

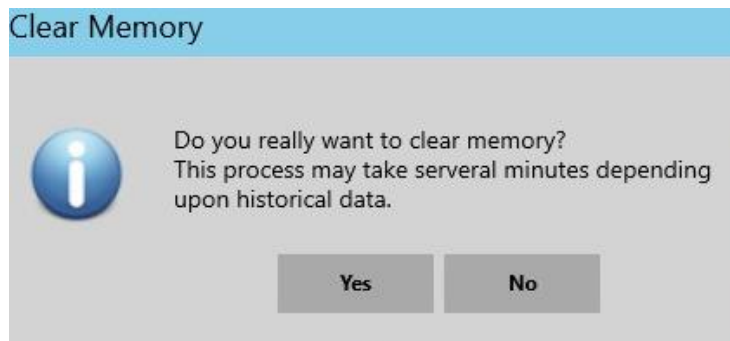


Figure 76 Final confirmation for clear memory

On pressing "Yes", device will restart, and all the databases will be cleared.

4.3 VIEW DATA

It contains information about Audit Trail, Event Summary and Historical Data. Audit trail and event summary module will be available in future versions. In Historical data module, the user can view list of historical batches and view group wise batch data for selected history batch.

4.3.1 Event Summary

Note: Current software version does not contain this feature. It will be available in future version.

4.3.2 Historical Data

Batch List: User can view historical data batch wise in the form of horizontal line graph or vertical line graph. On batch list page, all historical batches with batch name, batch start and batch stop time are displayed.

Path: Menu->view->Historical data

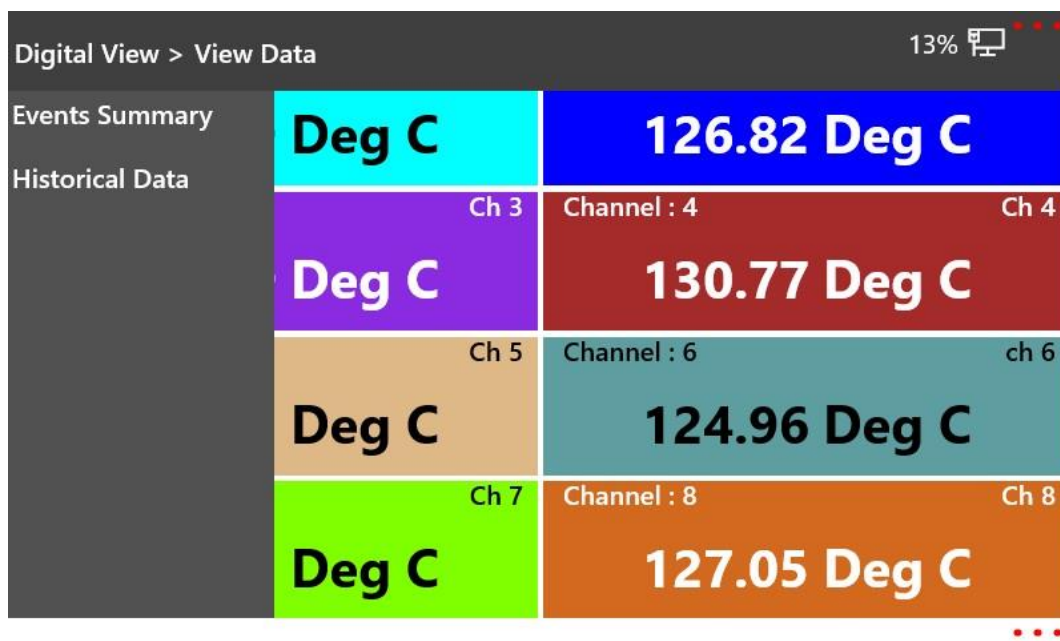


Figure 77- View Historical Data

ALL		Filter		
CSV	Graph	Batch Name	Batch Start	Batch Stop
Export	View	PL105_230620183931	23-06-2020 18:39:31	24-06-2020 14:12:00
Export	View	PL105_230620175850	23-06-2020 17:58:50	23-06-2020 18:27:10
Export	View	PL105_220620164500	22-06-2020 16:45:00	23-06-2020 15:24:03
Export	View	PL105_220620153000	22-06-2020 15:30:00	22-06-2020 16:21:33
Export	View	PL105_190620125000	19-06-2020 12:50:00	22-06-2020 12:11:04
Export	View	PL105_190620113115	19-06-2020 11:31:15	19-06-2020 11:45:56
Export	View	PL105_180620181235	18-06-2020 18:12:35	19-06-2020 09:25:40
Export	View	PL105_180620163327	18-06-2020 16:33:27	18-06-2020 17:08:08

Figure 78 Historical data page

On pressing button “Export”, historical batch data can be exported to a USB device in CSV format. The CSV File will be stored in the “**Logcontainer**” folder. On pressing button “View”, horizontal line graph of selected historical batch can be viewed.

On pressing button historical data from “View” page, it opens a list of historical batches. Here user can search historical batches between time intervals. On clicking button “Select” near start time and stop time, it allows to change search criteria based on date and time.

The following image shows list of historical batches between start time “23-06-2020 17:58:50” and “23-06-2020 18:39:31”.

ALL		Filter		
CSV	Graph	Batch Name	Batch Start	Batch Stop
Export	View	PL105_230620183931	23-06-2020 18:39:31	24-06-2020 14:12:00
Export	View	PL105_230620175850	23-06-2020 17:58:50	23-06-2020 18:27:10

Figure 79- Historical Data between a time interval

On pressing “View”, batch data can be viewed as a Horizontal trend graph, a vertical trend graph or a polar graph.

Historical Graph:

Historical Graph shows three types of graphs for the time period of batch start time to batch stop time.

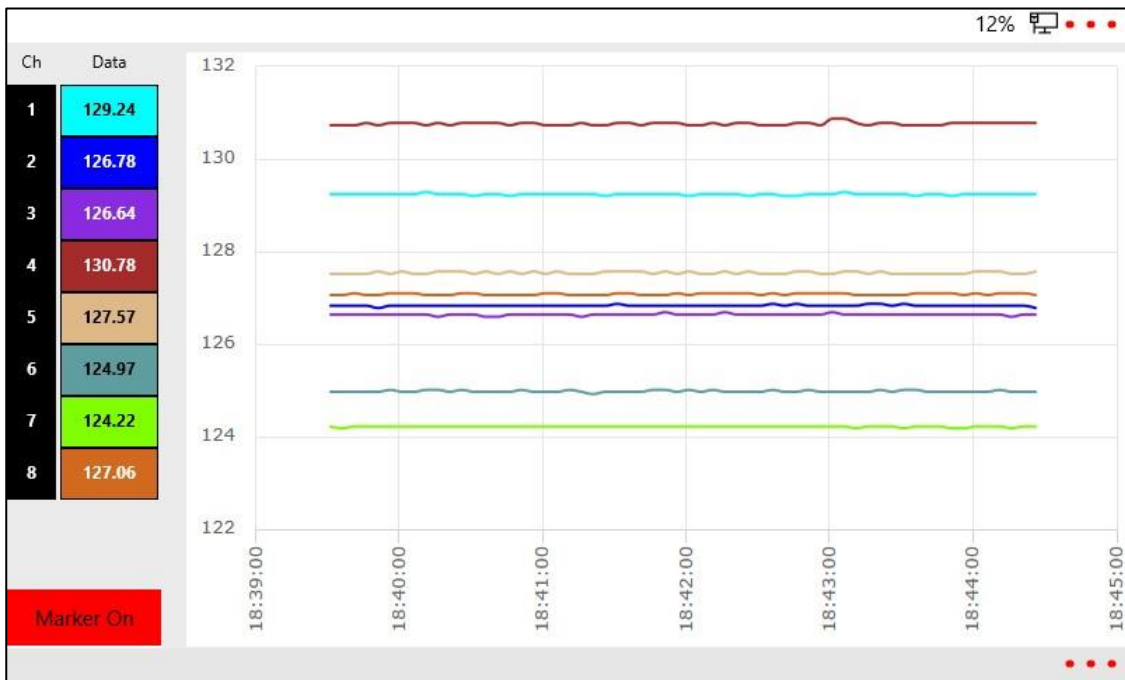


Figure 80 Historical Horizontal Line Graph

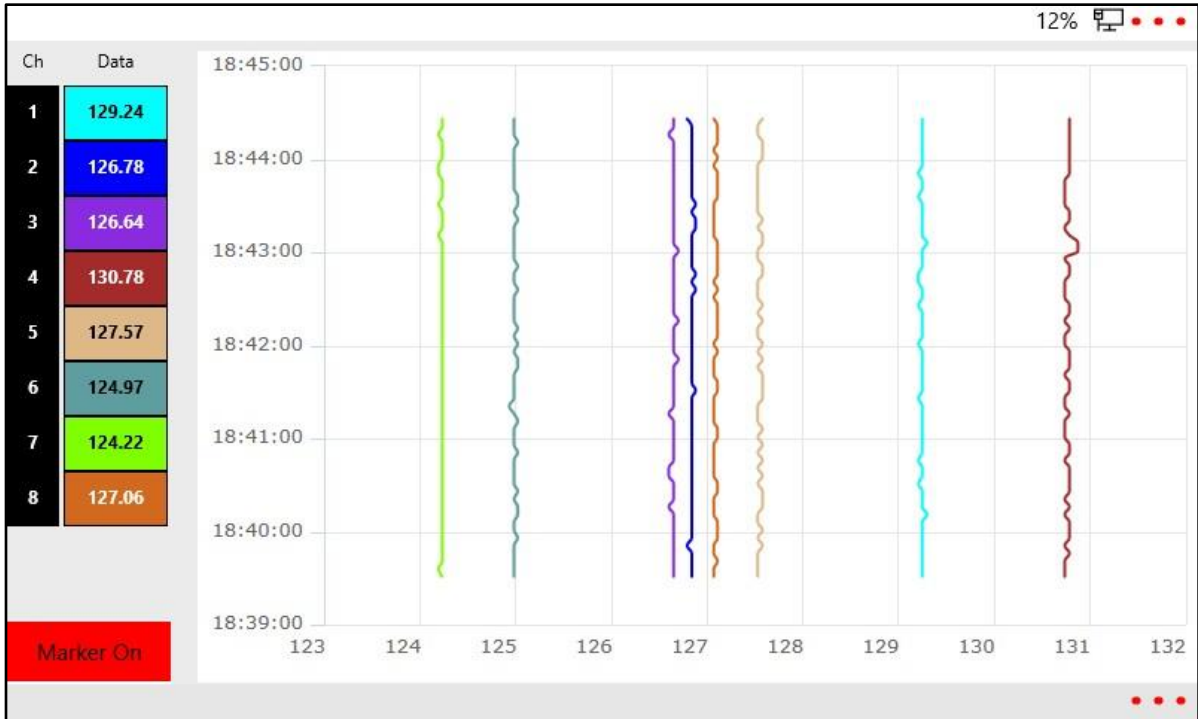


Figure 81 Historical Vertical Graph



Figure 82 Historical Polar Graph

User can see the graph on single page as per selected chart speed. Here chart speed is set to 5 minutes. Each page will show the data of cycle of 5 minutes. To see the data of next cycle or previous cycle, user should have to press the buttons as shown in the below figure.

1.**First**: On clicking button first, it displays the graph of first cycle of selected chart speed for selected batch.

2.**Previous**: On clicking button Previous, it displays the graph of previous cycle of selected chart speed for selected batch.

3.**Next**: On clicking button next, it displays the graph of next cycle of selected chart speed for selected batch.

4.**Last**: On clicking button Last, it displays the graph of last cycle of selected chart speed for selected batch.



Figure 83- Buttons to steer between Groups to view Historical data trend



Figure 84- Buttons to steer between different graphical views

The graphs can be seen group wise as well. On clicking “**Group**” it displays various groups on the left side as shown in the below figure.



Figure 85 Group wise Historical graph

User can see the graph for specific channels by skipping the unwanted channel on the legend shown on left side. User should only click on the channels shown on the left side in the legend. to remove from display.

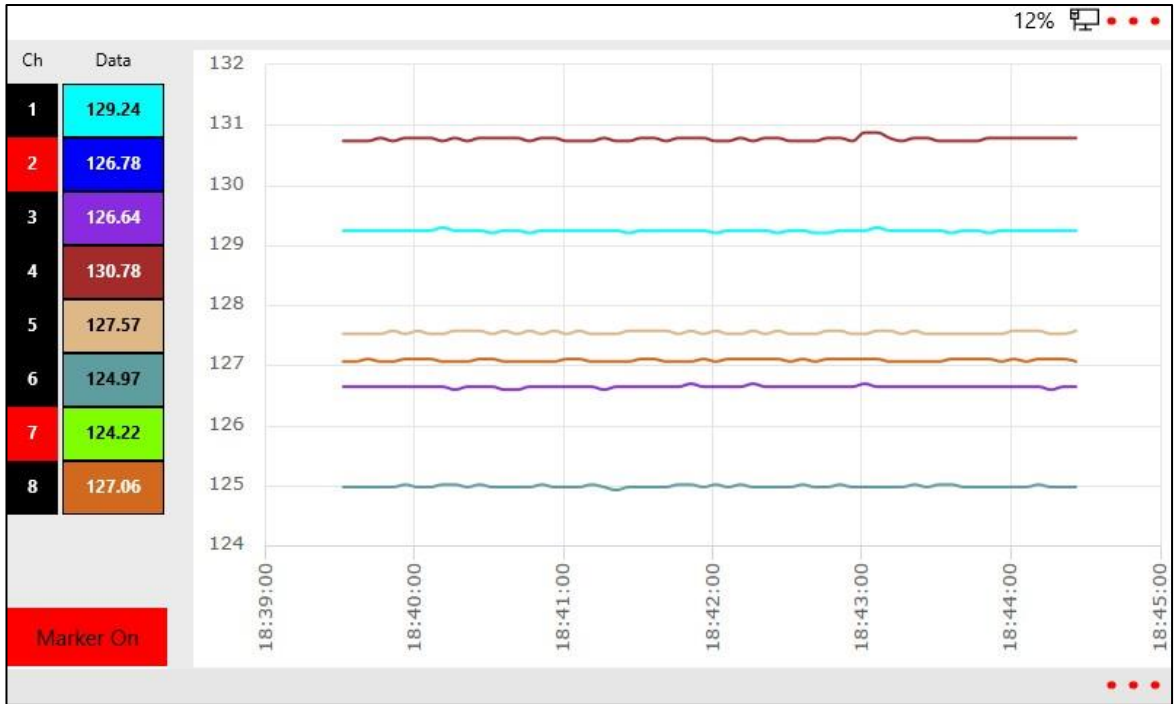


Figure 86 Skip channel in the historical graph

User can insert the mark on the graph for specific time on the graph by clicking on “Marker On” button.

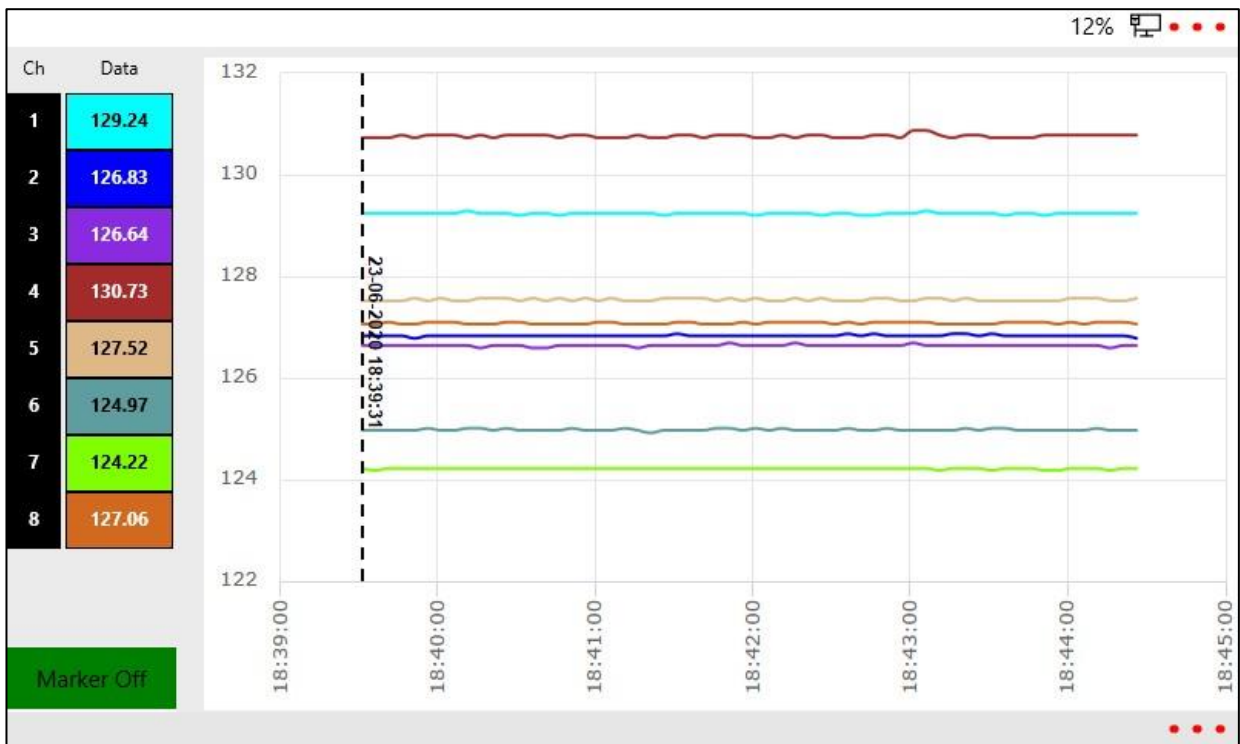


Figure 87 Graph marker

User can insert a note at specific time for any important event by clicking on the channel when marker is on.

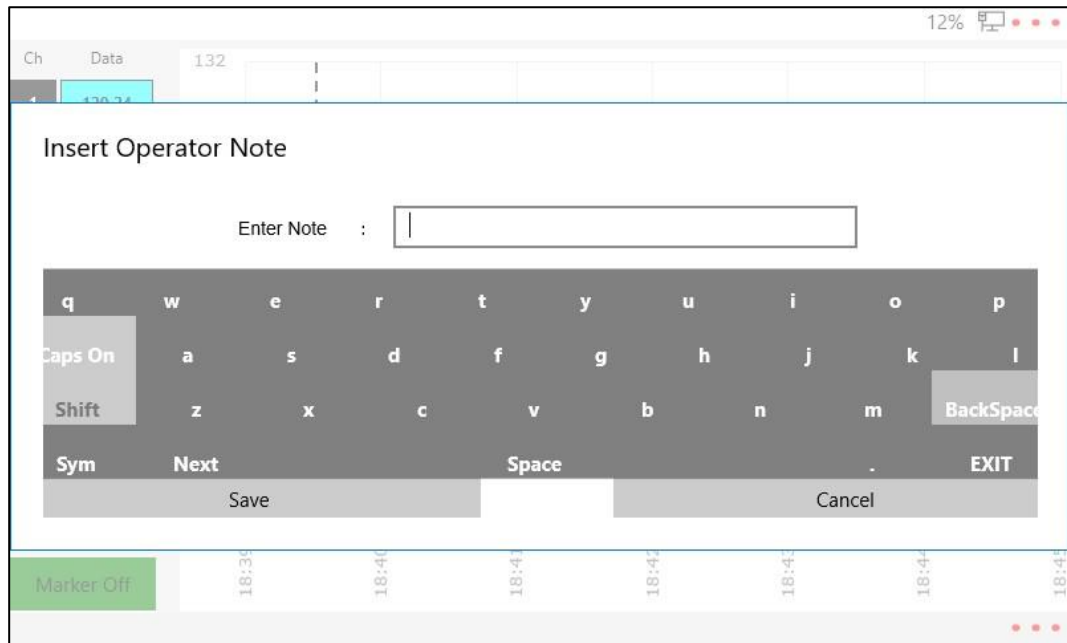


Figure 88 Insert operator note

5 CURRENT DATA

5.1 HEADER

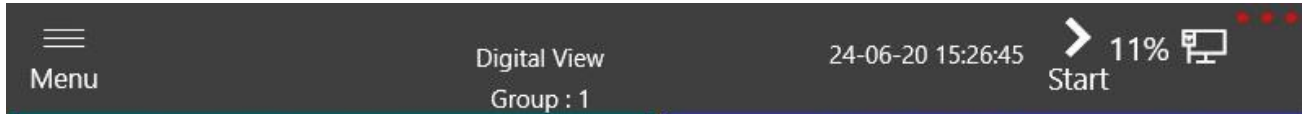


Figure 89 Header

All Current data pages have following header. In middle of the header, it shows name of the selected page, name of the selected group and current device RTC.

The “Menu” button redirects to the main menu of paperless application. The “Start”/ “Stop” buttons allow to start or stop the current batch. If batch is in running state, it contains “Stop” button and if batch is stop, then it contains “Start” button.

Note: If SD card memory is less than 500 MB, and if current batch is “Stopped”, user is not allowed to click on “Start” button because it is not enabled.

Current data can be viewed in the form of horizontal line graph, vertical line graph, horizontal bar graph, vertical bar graph and polar graph.

All current data pages have bottom panel which contains a button with three dots. On pressing it, buttons for selection of group and channels will appear. On clicking “Groups”, a sliding window which contains all groups within the current batch is opened. Although the first group is selected by default, user can select any group.

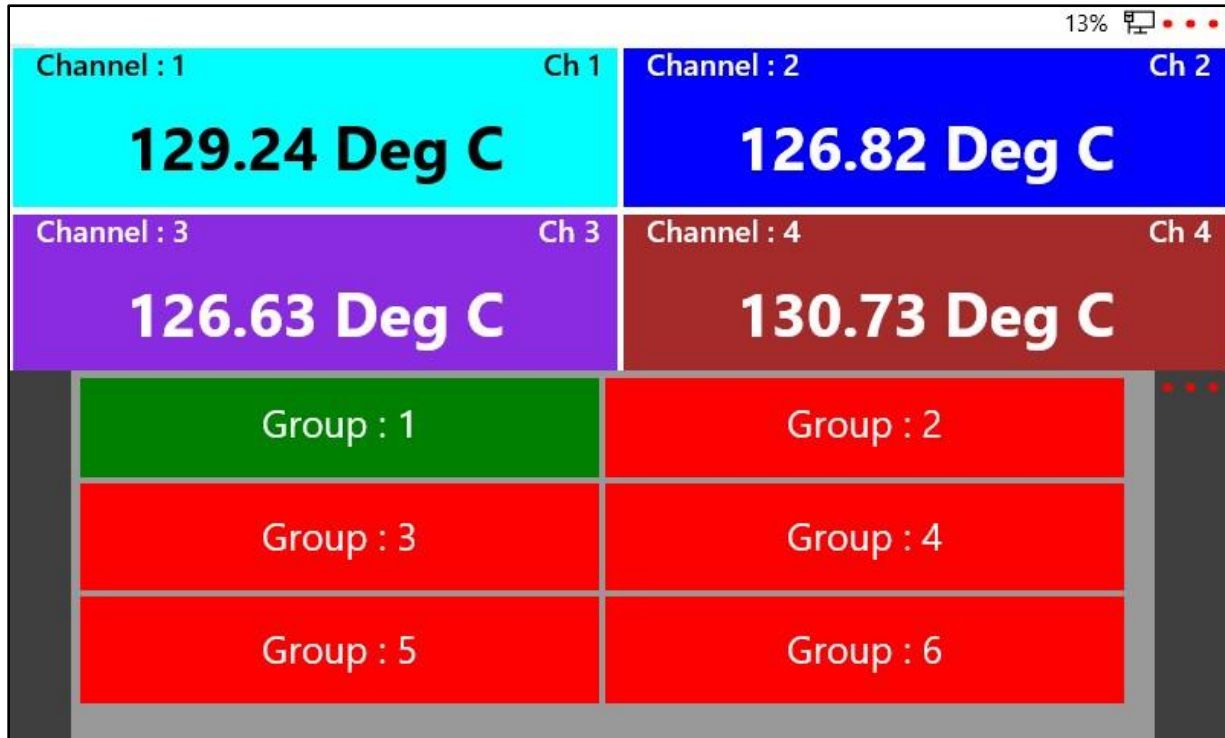


Figure 90 -Group menu on current data page

On clicking “Channels”, a sliding window which contains all channels within a group is opened. User can enable/disable any of the channels from this sliding window.



Figure 91- Channel selection menu on current data page

By default, all current data pages show last selected group and channels.

5.2 DIGITAL VIEW

Digital View page is the default page of paperless application. It shows current data of each channel with channel unit and tag within selected group. Also shows channel color indication as a background color of header of each channel data. Digital View page updates after every 5 second. By default, it shows first group and its channels. User can select group and channel from bottom panel. Digital View shows only those channels which are selected.

Digital View, Horizontal Bar Graph and Vertical Bar Graph have a refresh time interval of 5s while the store interval is as per that set in the channel's configuration.



Figure 92- Digital View of Current Data

5.3 HORIZONTAL BAR GRAPH

Horizontal Bar Graph page shows horizontal bar graph for current channel data. Horizontal Bar Graph page updates after every 5 second. User can select group from bottom panel and select channels. Horizontal Bar Graph page shows only those channels which are selected.

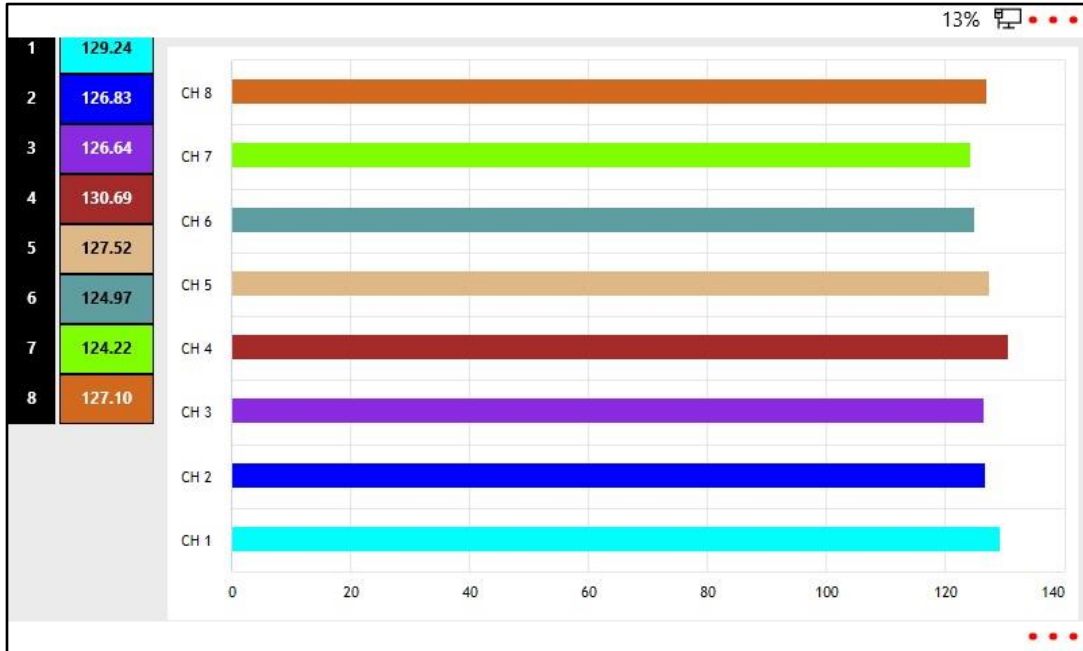


Figure 93- Horizontal Bar Graph for current data

Horizontal Bar Graph shows current Data vs. channels. Channel bar contains color same as channel color in channel configuration. Each bar displays current data on bar data tooltip. X-Axis has auto scaling facility as per minimum and maximum current data.

5.4 VERTICAL BAR GRAPH

Vertical Bar Graph page shows vertical bar graph for current channel data. Vertical Bar Graph page updates after every 5 second. User can select group from bottom panel, also selects channels. Vertical Bar Graph page shows only those channels which are selected.

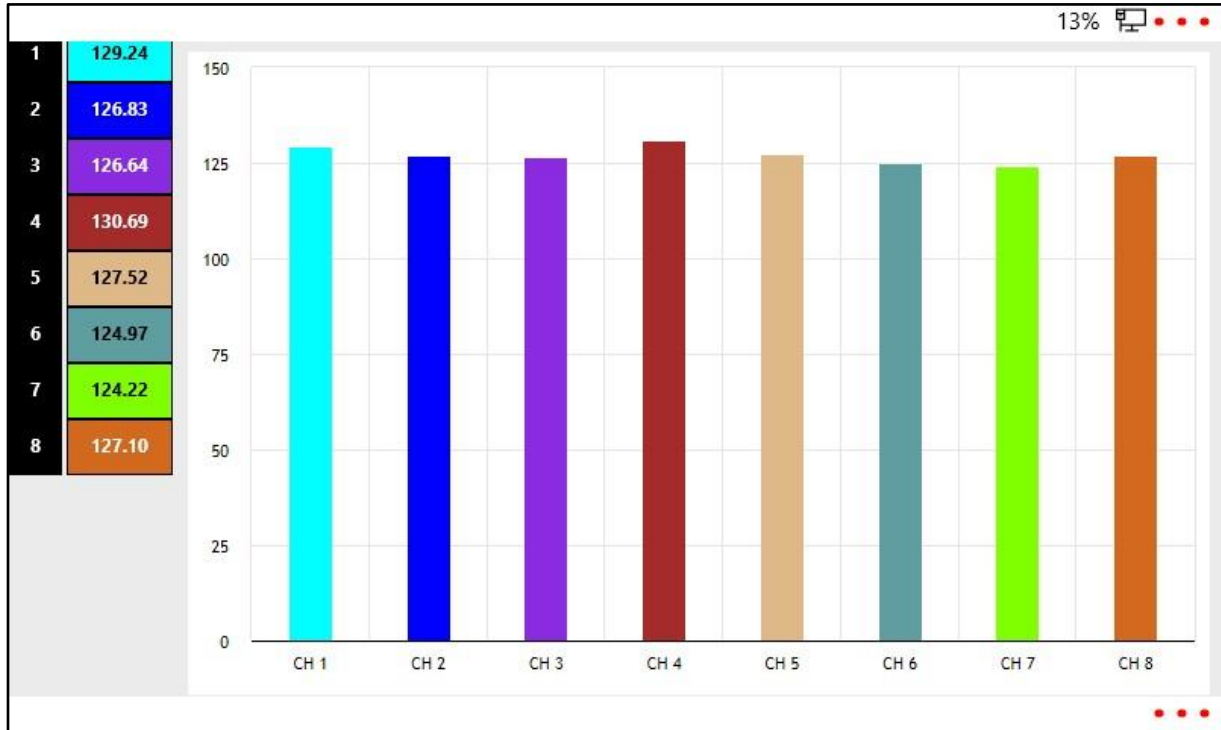


Figure 94- Vertical Bar Graph view for current data

Vertical Bar Graph shows channels Vs. current data. Channel bar contains color same as channel color in channel configuration. Each bar displays current data on bar data tooltip. Y-Axis has auto scaling facility as per minimum and maximum current data.

5.5 HORIZONTAL LINE GRAPH

This page shows horizontal line graph for current channel data. On the left side, it shows current data of each channel within the selected group. Also, channel color is indicated as a background color of each channel data. Horizontal line graph page updates after every trend interval selected for current batch. User can select group as well as channels from bottom panel. Online Trend Graph page shows only those channels which are selected. Line Graphs and Circular (Polar) charts are refreshed at a fixed time interval based on the chart speed selected. Please refer to Table 6 for update rate of the graph. **This update rate only applies to On-Line graph and has no relation to data storage time interval. Data will be invariably stored at a store interval.**

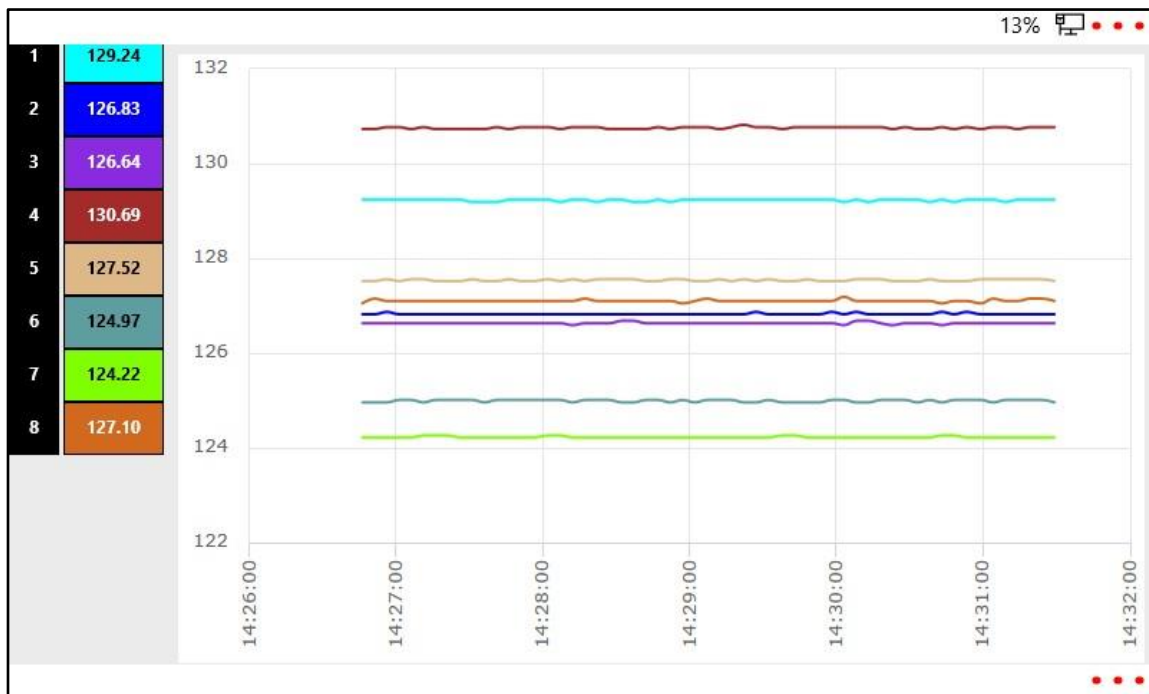


Figure 95- Online Horizontal Line Graph

Horizontal Line Graph shows Time Vs. channel current data. Channel series contains color same as channel color in channel configuration. Y-Axis has auto scaling facility as per minimum and maximum current data for all series.

Table 6 Chart Speed Selected V/S Graph Update Rate

Chart Speed Selected	Graph Update Rate
5 minutes	5 Seconds
10 minutes	10 Seconds
15 minutes	15 Seconds
30 minutes	20 Seconds
1 Hour	1 minute
4 Hour	1 minute
8 Hour	2 minutes
12 Hour	3 minutes
16 Hour	4 minutes
24 Hour	6 minutes

5.6 VERTICAL LINE GRAPH

This page shows vertical line graph for current channel data. On the left side, it shows current data of each channel within selected group. Also, channel color is indicated as a background color of each channel data. Vertical line graph page updates after every trend interval selected for current batch. User can select groups as well as channels from left side panel. Online Strip Graph page shows only those channels which are selected.

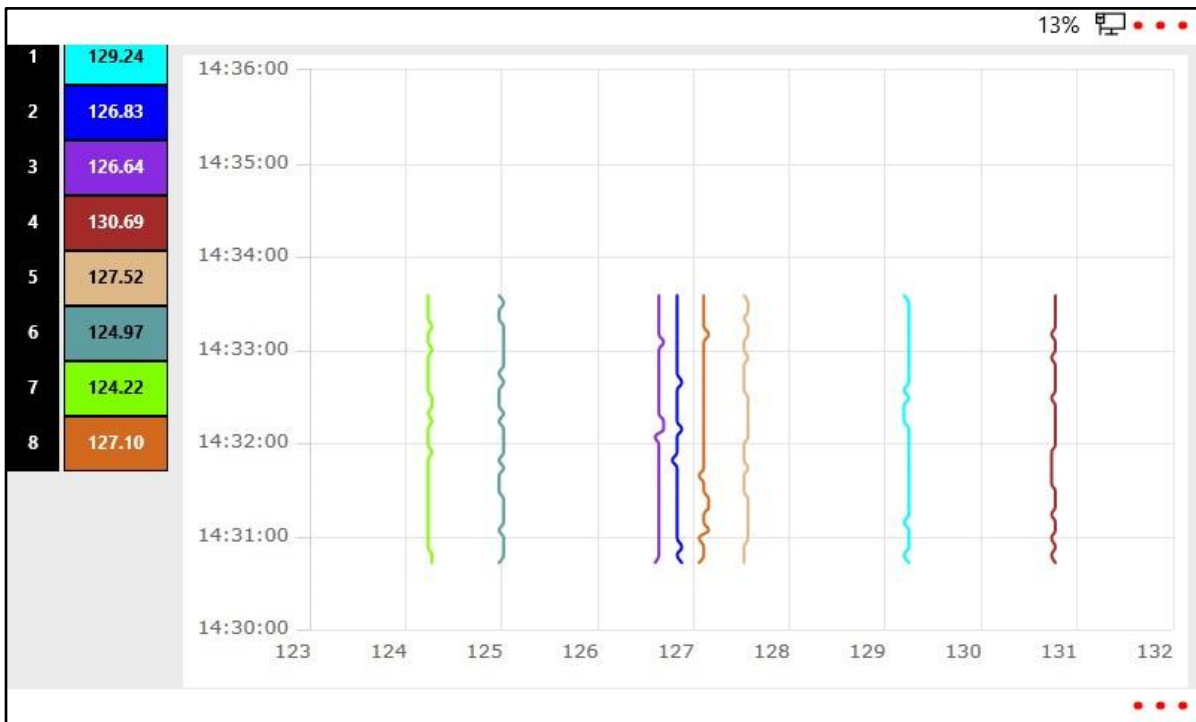


Figure 96- Online Vertical Line Graph

Vertical Line Graph shows channel current data Vs. Time. Channel series contains color same as channel color in channel configuration. X-Axis has auto scaling facility as per minimum and maximum current data for all series.

5.7 POLAR GRAPH

Polar graph is the circular representation (Data vs. Time) of the data with the radial axis indicating data value while the angular axis representing time. Chart Speed set in channel configuration, is the maximum time interval represented in the graph.

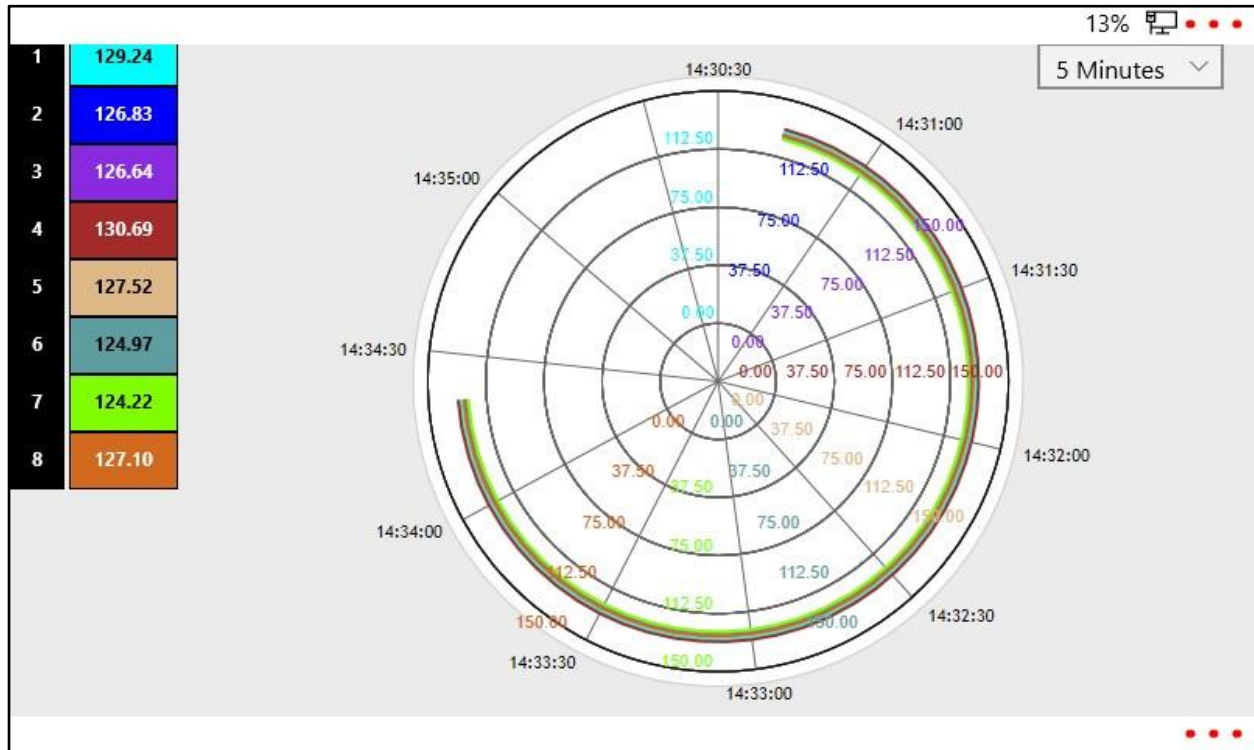


Figure 97-Online Polar Graph

6 DEVICE TOUR

This menu is not available in current version.

7 ABOUT

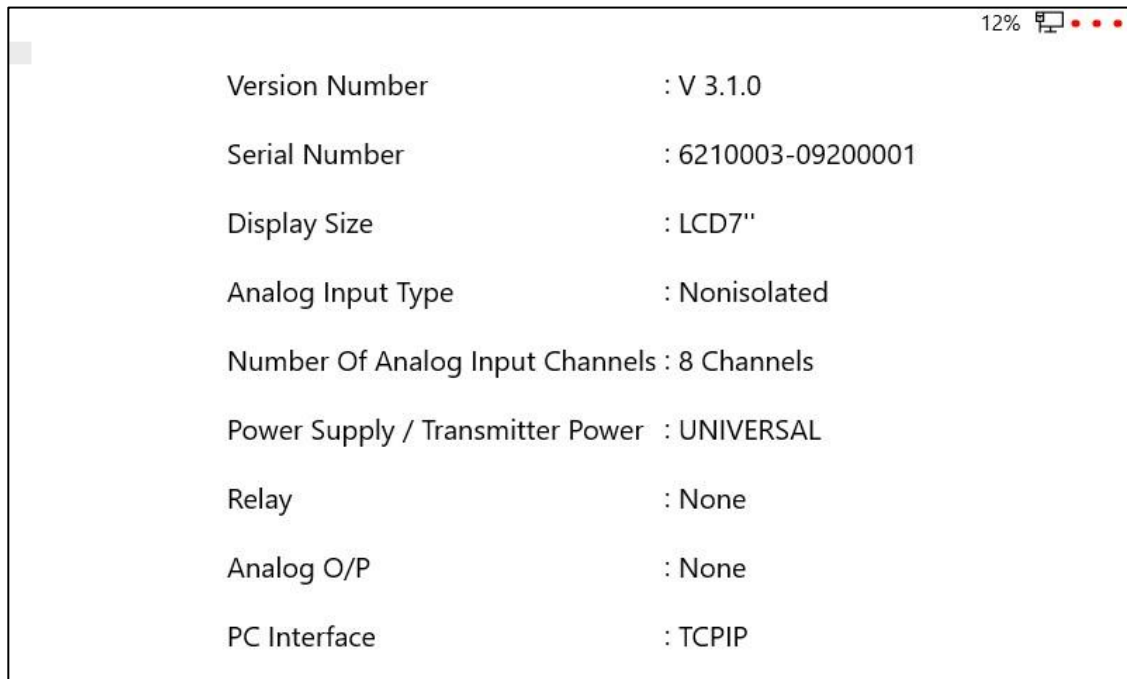
This menu shows the information regarding the company.



Figure 98 About Menu

8 DEVICE INFORMATION

User can see the device information such as, Version no., Product code, Serial No., Display size, Analog input type, No. of analog input channels, Power supply/Transmitter power, Relay, Analog O/P and PC interface.



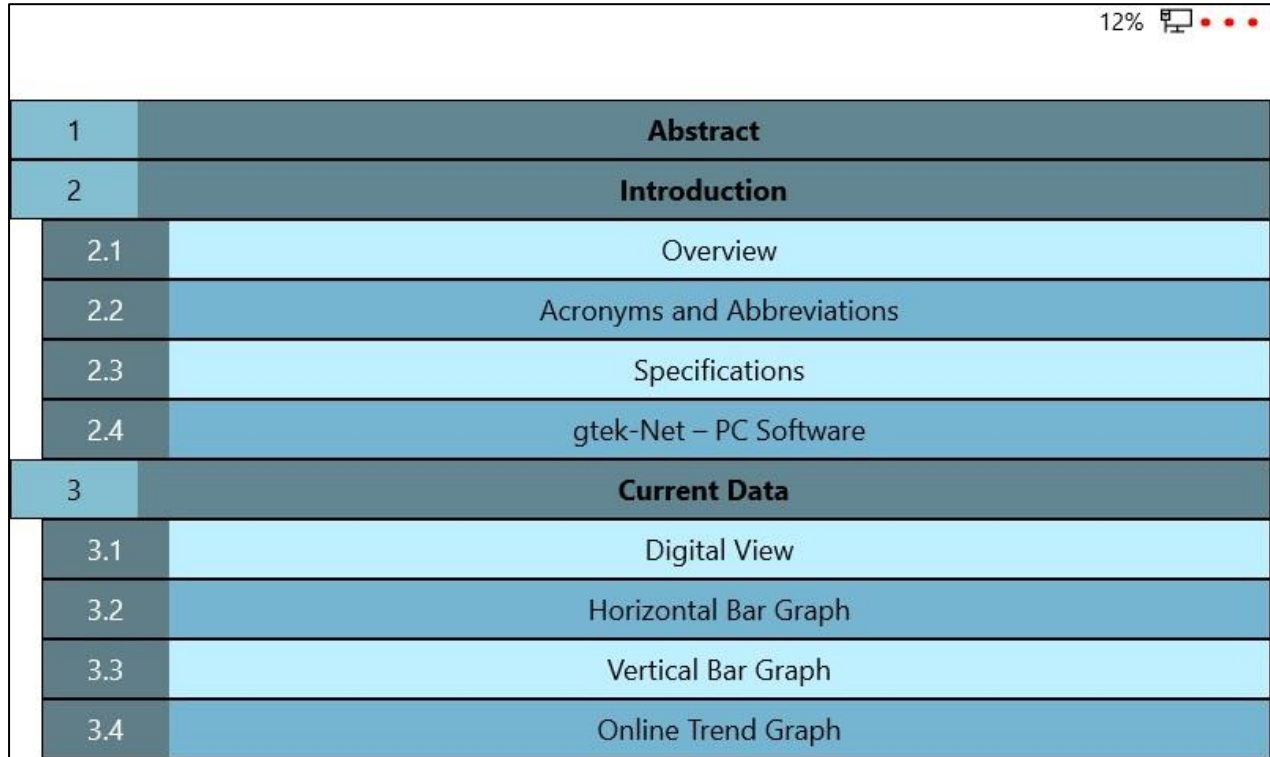
The image shows a screenshot of a device's information screen. The screen has a white background with black text. In the top right corner, there is a status bar showing '12%' and a battery icon with three red dots. The main content is a list of specifications, each on a new line, with the label on the left and the value on the right, separated by a colon. The specifications are: Version Number: V 3.1.0; Serial Number: 6210003-09200001; Display Size: LCD7"; Analog Input Type: Nonisolated; Number Of Analog Input Channels: 8 Channels; Power Supply / Transmitter Power: UNIVERSAL; Relay: None; Analog O/P: None; PC Interface: TCPIP.

Version Number	: V 3.1.0
Serial Number	: 6210003-09200001
Display Size	: LCD7"
Analog Input Type	: Nonisolated
Number Of Analog Input Channels	: 8 Channels
Power Supply / Transmitter Power	: UNIVERSAL
Relay	: None
Analog O/P	: None
PC Interface	: TCPIP

Figure 99 Device Information

9 HELP

Help regarding the operation of the device, is available in this menu.



The image shows a screenshot of a help menu interface. At the top right, there is a battery status indicator showing 12% and three red dots. The menu is organized into three main sections, each with a dark blue header and a light blue left margin. Section 1, 'Abstract', contains item 1. Section 2, 'Introduction', contains items 2.1 through 2.4. Section 3, 'Current Data', contains items 3.1 through 3.4. The items are listed in a table-like structure with alternating light and dark blue background colors for the content rows.

1	Abstract
2	Introduction
2.1	Overview
2.2	Acronyms and Abbreviations
2.3	Specifications
2.4	gtek-Net – PC Software
3	Current Data
3.1	Digital View
3.2	Horizontal Bar Graph
3.3	Vertical Bar Graph
3.4	Online Trend Graph

Figure 100 Help Menu

10 TROUBLESHOOTING GUIDE

1. *Problem:* At power on, display screen appears blank

Solution:

- a. Check if a working supply cable is connected correctly
- b. Check Mains supply
- c. Check if internal LEDs are ON or OFF.

Try turning the device OFF and then turn it ON again.

2. *Problem:* Blue Screen appears on the display

Solution: If an error message reads: 'OS/ SD Card Corrupt', contact a factory personnel.

3. *Problem:* Channel data is not updated as per input type and range:

Solution:

- a. Check channel configuration parameters
- b. Check sensor connection wiring
- c. If the problem still persists, re-calibrate the channel.
- d. Try factory reset on the device. (This would not erase the channel data. It will only modify the parameters.)

4. *Problem:* Check device communication:

Solution:

- a. Access webpage using IP address. If it doesn't load,
 - i. Check LED on TCP/IP connector.
 - ii. If the LEDs are off, check the cable.
- b. If the problem still persists, contact a factory personnel


5. *Problem:* What type of pen drives are supported by the device?

Solution:

- a. Storage space of up to 16 GB

6.Problem: How to change the System Language?

Solution:

- b. Press on the top-right corner of the screen
- c. Press 
- d. Select the second option from the main menu
- e. Then select the first option and system language options will be seen

7. Problem: Screen is stuck or is loading for more than 5 minutes

Solution:

- Wait for up to 10 min the device should restart automatically.
- If doesn't auto restart, then try switching the device OFF and then turn it ON again.
- Contact factory personnel.

11 TECHNICAL SPECIFICATIONS

Model No	PL700 Series; 7" recorder
Product Code*	6xxxxxx-x
Display:	
Display Type:	TFT Color LCD
Display Size:	7"
Viewable Screen:	155mm x 86mm
Display Resolution:	800 x 480 pixels
Color Resolution:	24 bits
Touch Screen:	10 fingers Capacitive
Display Screen:	Digital View, Bar Chart, Horizontal trend, Vertical trend, Circular Chart, Menus and other user interface screens
Multilingual:	Multiple language support – Hindi, Gujarati, English, French, German and Portuguese

General Specifications:

CPU:	1.2 GHz 64-bit quad-core ARMv8 CPU
Internal Data Storage:	SD Card – 16GB; Expandable to 32GB
USB Host:	1; In Front
Data Update Rate:	2 Hz
Data Store Interval:	1 seconds to 18 Hours
21CFR Part 11 Compliance:	Optional
Maximum No of Slots per Recorder:	5

Communication:

Communication Port:	10/100BaseT (IEEE 802.3) Ethernet Port
Connector:	RJ45
Protocols Supported:	MODBUS TCP/IP slave; HTTPS; FTP
Communication Activity LED:	Yes
Isolation:	1.5 kV 1 Minute; (As per IEC 61010-1)

Environmental:

Temperature:	<i>(Operation)</i> 5°C to 45°C <i>(Limiting)</i> 0°C to 50°C <i>(Storage)</i> -20°C to 60°C
Humidity:	<i>(Operation)</i> 10 to 80 % RH Non-Condensing <i>(Storage)</i> 5 to 90 % RH Non-Condensing
Altitude:	<2000 meter

Safety / EMI-EMC:

EMI-EMC:	IEC 61326-1 Class B
Safety:	IEC 61010-1
Pollution Degree:	II
Installation Category:	III
Vibration Category:	2g Peak (10Hz – 150Hz)
Shock:	IEC 61010- 1
IP Rating:	IP 65 (Only front Bezel)

Power Requirement:

Supply Voltage (Mains Operated through adapter):	85-264 V AC 47-63 Hz
Power:	35 W Max with Maximum Configuration
Fuse Type:	None

Analog Input Board

No of Output Channel per Board:	8
No of slots consumed per Board:	1
Sensor Input type:	Refer to table 1
Range and Accuracy:	Refer to table 1
Linearization:	For RTD; Thermocouples; Square Root; 3/2 Power; 5/2 Power; Log10
Linearization Error:	±0.05 °C Max
Resolution:	User Settable up to 0.0001
CJC Accuracy:	±0.5°C
Sensor Open / Short / Out of Range:	Yes
Samples per second:	Max 26 samples per second all channels
Input Impedance RTD / TC / Volt:	> 20 MΩ
Input Shunt for 4-20mA and 0-20mA:	50 Ω ±0.1% 1/4W External
CMRR:	> 120 dB @50, 60Hz @ 50 Samples per second
NMRR:	> 87 dB @50, 60Hz @ 50 Samples per second
Maximum Common Mode Voltage:	30 V DC
Isolation Channel – Channel:	2.5 KVrms 1 minute (IEC 61010-1)
Isolation Channel – Earth:	2.5 KVrms 1 minute (IEC 61010-1)
Input Protection:	60 V AC/DC Max

Analog Output Board:

No of Inputs per Board:	4
No of Slots consumed per board:	1
Output type User Settable:	mA / Volt
Accuracy:	±0.1 % FSR
Temperature Drift:	±0.01 % FSR/°C @ 25°C
Resolution:	16 bits
Step Response:	250 ms (10 – 90%)
Output Refresh Rate:	500 ms
Self-Diagnostics:	Fault Indication for each output
Isolation Channel – Channel:	2.5 KVRms 1 minute (IEC 61010-1)
Isolation Channel – Earth:	2.5 KVRms 1 minute (IEC 61010-1)

mA:

Range:	0-20 mA; 4-20 mA
Open Circuit Indicator:	Yes
Maximum Load Resistive:	600 Ω
Maximum Load Inductive:	50mH
Max Current Output:	24 mA
Short Circuit Protection:	Yes

Voltage:

Range:	0 - 5V; 0-10V; ± 5V; ± 10V DC
Output Impedance:	1 KΩ Maximum
Maximum Capacitive Load:	1 μF
Max Load:	10 mA
Short Circuit:	Protected

Relay Output Board

No of Input Channel per Board:	4
No of slots consumed per Board:	2
Relay Output type:	High / Low / On-Off / PID
Output Type:	1 Form C (C-NC-NO)
Life expectancy:	Mechanical: 10 ⁷ operations
Relay Contact Ratings:	Electrical: 10 ⁵ operations
Relay Contact Ratings:	1 A, 230V AC resistive
Relay refresh rate:	500 msec
Isolation Relay – Relay:	2.5 KVRms 1 Minute (IEC 61010-1)
Isolation Relay Contact – GND:	1.5 KVRms 1 Minute (IEC 61010-1)

Transmitter Output Power:

Maximum no of Output:	2
Output Voltage:	24 V DC
Max Current:	30 mA
Short Circuit:	Protected
Isolation Output – Earth:	1.5 KVRms 1 minute (IEC 61010-1)

Suggested Sensor Input:**Suggested Sensor Accuracy At 25°C**

<i>Sensor Type</i>	<i>Standard</i>	<i>Range</i>	<i>Error</i>	<i>Error% Input</i>	<i>Error% Range</i>	<i>Error Temperature Coefficient ppm/C</i>
RTD Type						
Pt 100	IEC751	-200 to +850	0.01°C	0.04%	0.04%	30ppm
T/C Type						
J	IEC584.1	-210 to +1200	0.02°C	0.03%	0.05%	25ppm
K	IEC584.1	-270 to +1372	0.04°C	0.03%	0.05%	25ppm
C	Hoskins	0 to +2300	0.12 °C	0.03%	0.05%	25ppm
R	IEC584.1	-50 to +1768	0.04°C	0.03%	0.05%	25ppm
S	IEC584.1	-50 to +1769	0.04°C	0.03%	0.05%	25ppm
T	IEC584.1	-270 to +400	0.02°C	0.03%	0.05%	25ppm
B	IEC584.1	0 to +1820	0.03°C	0.03%	0.05%	25ppm
E	IEC584.1	-270 to +1000	0.03°C	0.03%	0.05%	25ppm
N	IEC584.1	-270 to +1300	0.04°C	0.03%	0.05%	25ppm