

### **General Parameter**

- Data Communication: Modbus **TCP** protocol.
- Physical Connectivity : RJ45.
- Holding Register → Data type – 16 bit Integer unless stated otherwise.
- The Term “SensorCount” indicates the No of Sensors installed for the project.
- The maximum numbers of sensors is restricted to 40.
- Date Time to be displayed at bottom right of all the screens.
- Title on all the screens to be as shown below:



- Home Icon navigates to Main Screen.
- Left Arrow navigates to Previous Screen.
- Right Arrow navigates to Next Screen.
- Input validation shall be ensured based on the data range and logical conditions (if any) specified against the input elements. Any out of range values shall not be accepted and existing values shall be retained with suitable warning message.
- **Flashing Pop up Alarm** to be displayed on the occurrence of Leak detection of any one of the channel (Tag No: 260 to 299 – Bit No **1**). Sensor No is based on the Tag No assigned in sequence. **This Pop-up shall be shown irrespective of the currently displayed screen.**



- Clicking on the Alarm Pop-Up shall navigate to the Mimic Screen with highlighted sensor which had sensed Steam leakage.
- All the input fields accepts only numerical values and only NumPad pop-up shall be used.
- All the Radio Button shall Glow-Red Color if the corresponding bit is read as 1.

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

### **List of Screens in Order:**

<b>Screen number</b>	<b>Title of Screen</b>	<b>Password Protection Required</b>
<b>1</b>	Main Screen	-NA-
<b>2</b>	Bar Graph 1 of 2. This screen is repeated based on the no of sensors which is split into two (2) screen.	-NA-
<b>3</b>	Frequency Spectrum	-NA-
<b>4</b>	RealTime Trend 1 of 4. This screen is repeated based on the no of sensors grouped 10 per screen.	-NA-
<b>5</b>	Mimic Screen	-NA-
<b>6</b>	Sensor Profile	-NA-
<b>7</b>	Sensor Settings	<b>YES</b>
<b>8</b>	System Settings	<b>YES</b>
<b>9</b>	Sensor Status 1 of 2. This screen is repeated based on the no of sensors which is split into two (2) screen.	-NA-

## BHELSONIC 20i HMI INTERFACE DEVELOPMENT

REF: BS20i-HMI-R1  
12.02.2022

### 1.0 Main Screen:



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

**REF: BS20i-HMI-R1**

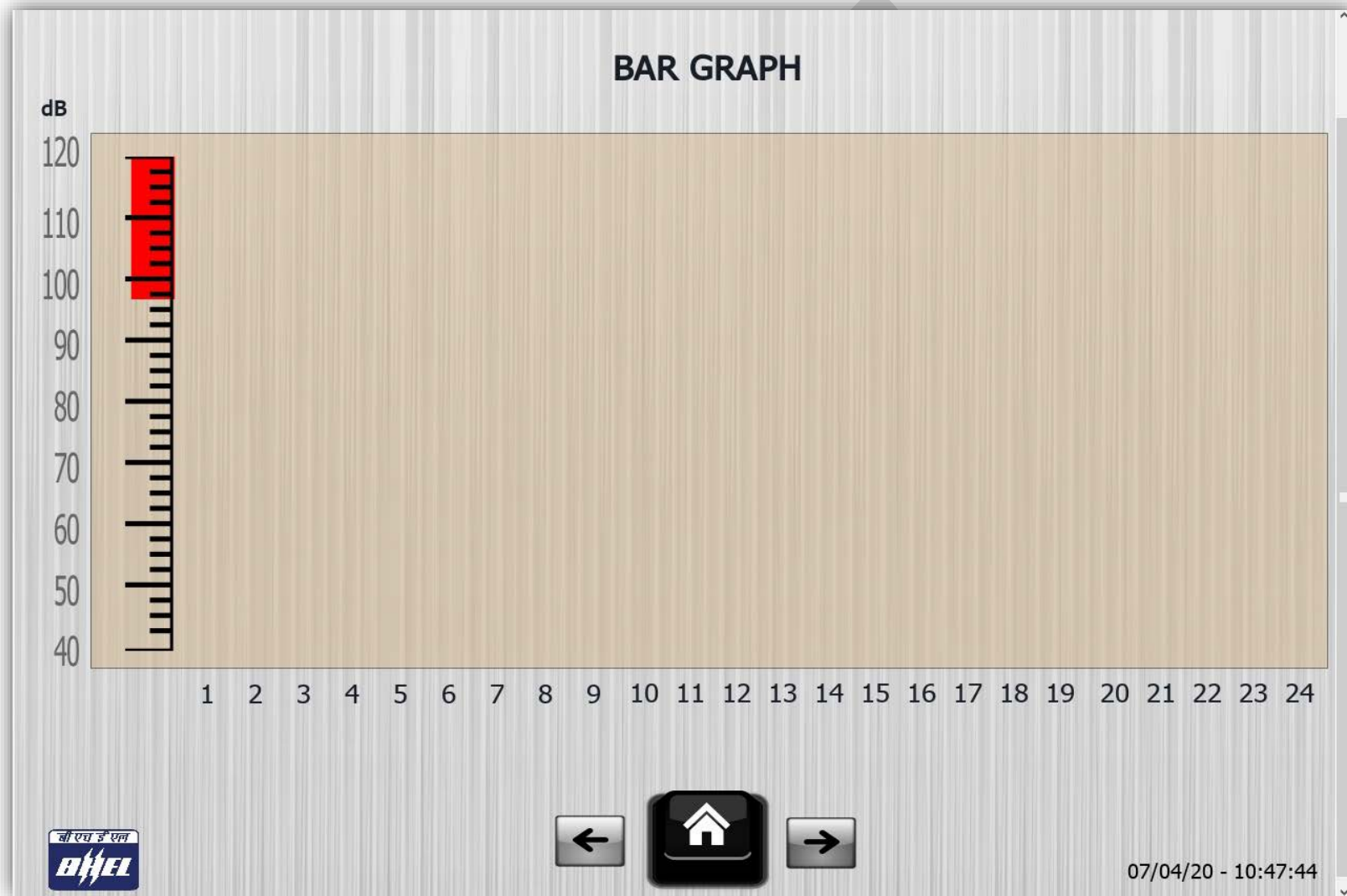
**12.02.2022**

This is the home screen containing the links to all menus.

The buttons / images in the screen is used to navigate to the respective menus through on click event.

<b>Type</b>	<b>Name</b>	<b>Tag Id</b>	<b>Event</b>
Image	Bar Graph	N/A	Navigate to Bar Graph Screen
Image	Frequency Spectrum	N/A	Navigate to Frequency Spectrum Screen
Image	Trends	N/A	Navigate to Real time Trends Screen
Image	Mimic	N/A	Navigate to Mimic Screen
Image	Sensor Profile	N/A	Navigate to Sensor Profile Screen
Image	Settings	N/A	Navigate to System Settings Screen
Image	Status Summary	N/A	Navigate to Sensor Status Screen
Image	Help	N/A	Display in Pop-up HMI Software Version & BS20i Firmware Version

**2.0 Bar Graph:**



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

- 2.1 This menu is used to display the dB level of all the connected sensors.
- 2.2 X-axis of the graph represents the sensor number and Y-axis represents the dB level ranging from 40 to 120 [Linear Scaling].
- 2.3 No of bars in X-axis shall be based on the Sensor Count for the project but limited to **half of the total sensors** per screen.

---

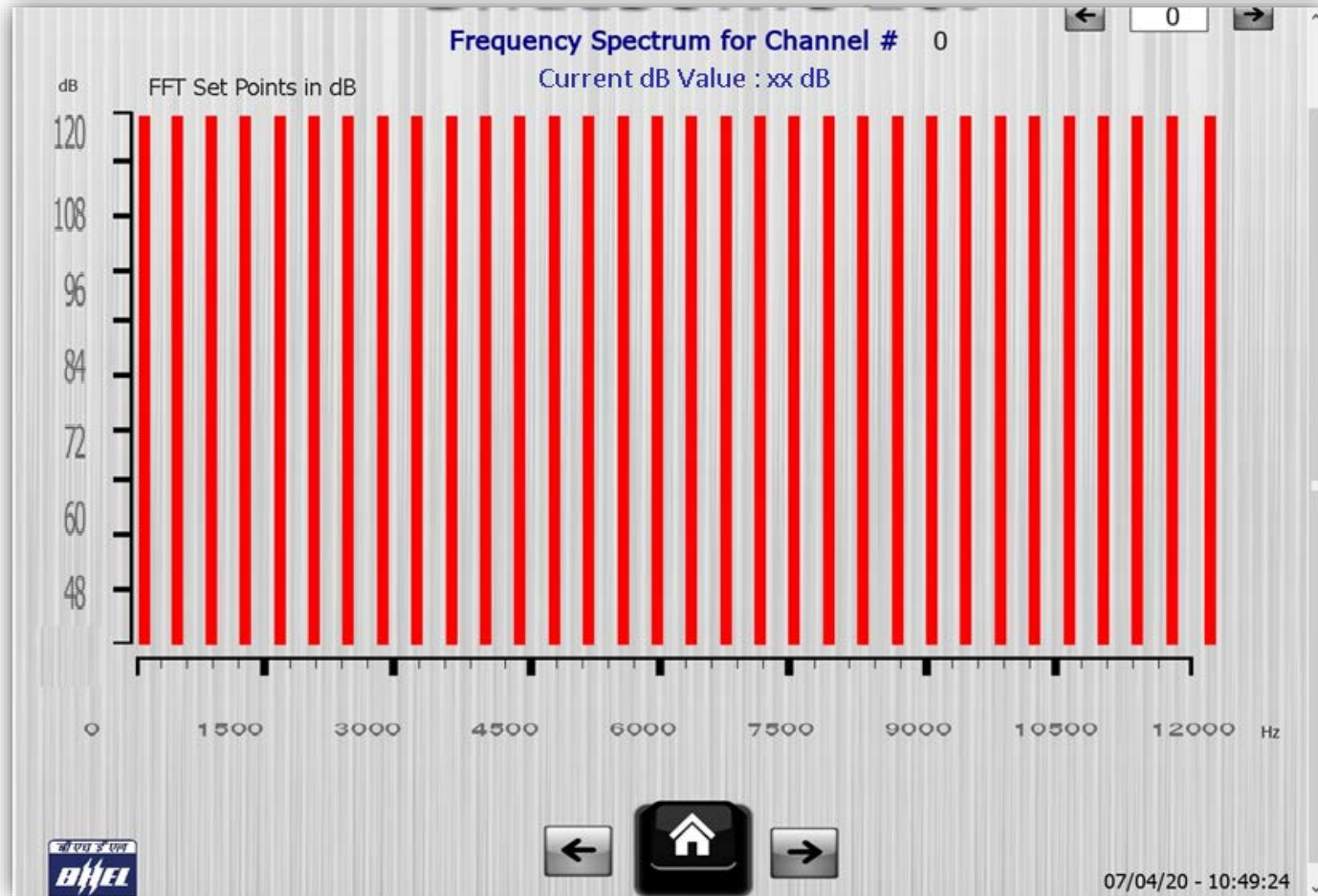
*For Projects having more than 20 sensors – The number of sensors in the screen shall be suitable split across.*

*Instance, 34 number of sensors shall be split to 17 x 2 screens.*

---

Type	Name	Tag Id	Address Range (Min / Max)	Event
Bar Graph	Graph	Channel #01 to #40	200 to 239	N/A

**3.0 Frequency Spectrum:**



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

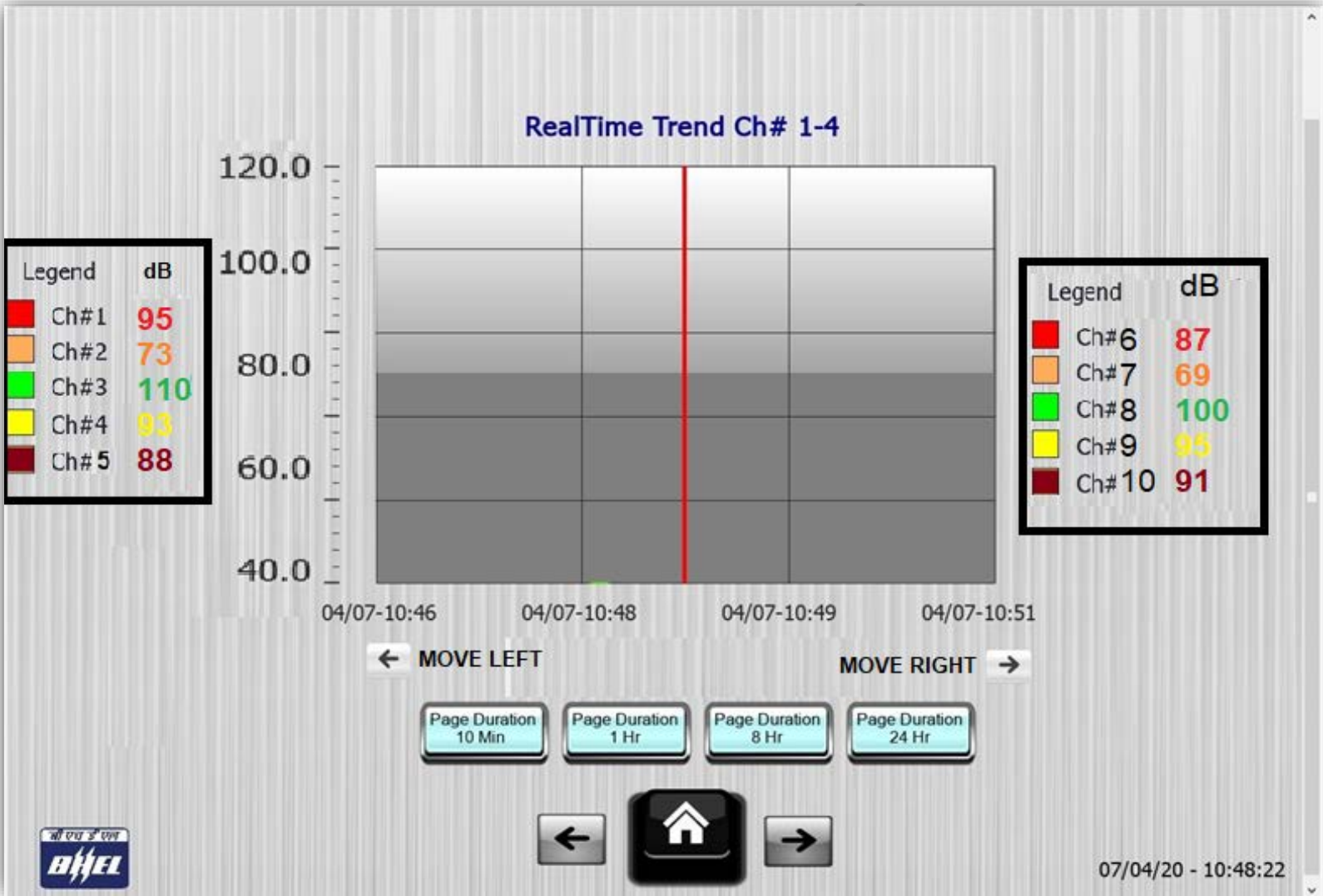
### **Frequency Spectrum**

- 3.1 This screen is used to show the dB level of frequency spectrum for the selected sensor (in top right corner).
- 3.2 The left and right arrow shall be used for selecting the sensor. Default on Startup shall be sensor #1.
- 3.3 [Increment & Decrement Sensor Number cyclic between 1 & Maximum SensorCount ]
- 3.4 Option to type in the sensor number directly in the text box shall also be provided.
- 3.5 The frequency spectrum in X-axis ranges from 0 to 12 kHz containing 32 bands.
- 3.6 The dB level in Y-axis ranges from 40 to 120 dB.
- 3.7 Each band of frequency spectrum has 2 bars namely bottom bar indicator and top bar indicator.
- 3.8 The bottom bar indicator [**Green Color**] shall display the current dB value of the band and the top bar indicator [**Red Color**] displays the FFT Alarm Set Points for a given frequency band for the selected sensor.
- 3.9 If the bottom bar reaches the top bar i.e, the dB level at the given frequency spectrum reaches/crosses the alarm set point, alarm indication shall be raised through blinking animation.

Type	Name	Tag Id	Data Range (Min / Max)	Remarks
Bar Graph	Bottom bar indicator FFT of selected Sensor	14 to 45 (33 bands)	NA	<b>Green Color</b>
Bar Graph	Top bar indicator FFT Set Point of selected sensor	146 to 177 (32 bands)	NA	<b>Red Color</b>
Label	Current dB	11	NA	Shown as 'xx'
Text Box (between arrow)	Channel No	9	1 to SensorCount	Default on Startup Value = 1
Button	Left Arrow	9	1 to SensorCount	Decrement Tag #9 value by 1. If the value of Tag#9 =0, then, set Tag#9 to SensorCount
Button	Right Arrow	9	1 to SensorCount	Increment Tag #9 value by 1. If the value of Tag#9 > SensorCount, then, set Tag#9 to 1



**4.0 RealTime Trend:**



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

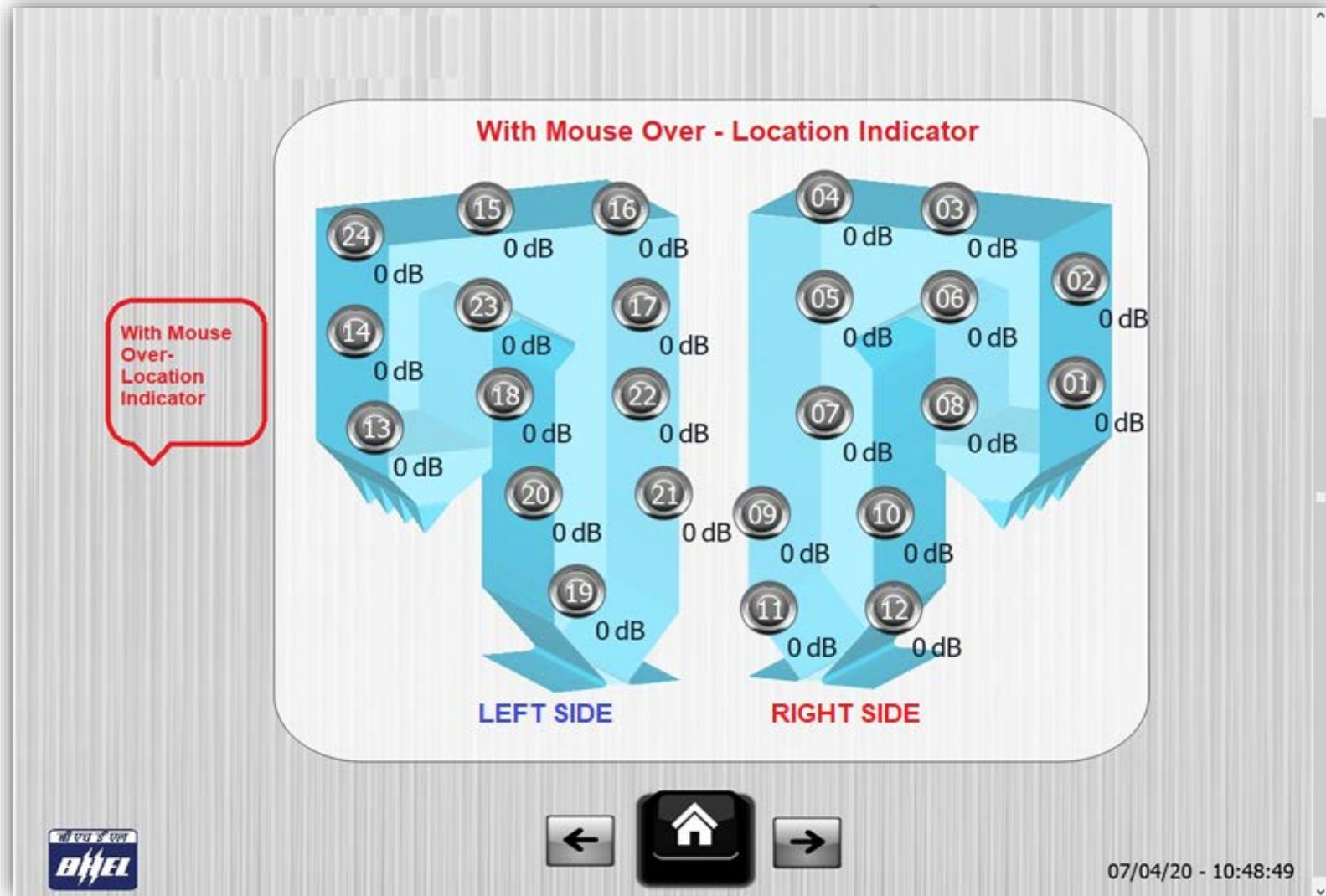
12.02.2022

### **RealTime Trend:**

- 4.1 This menu is used to show the real time trend of the sensor's dB value grouped as 10 sensors in each screen.
- 4.2 Title of the trend graph shall be based on the group selected for instance, RealTime Trend Channels # 01-10.
- 4.3 The Arrows below the graph shall navigate X axis Time view.
- 4.4 The color for each sensor trend shall be different to distinguish visually.
- 4.5 Color Code legend shall be indicated next to the Trend along with the Live dB Values.
- 4.6 Default X-axis timer shall be of 10 min duration.
- 4.7 Default Y-axis timer shows the dB level ranging from 40 dB to 120 dB [Linear Scale].
- 4.8 Option to change the Page Duration [10Min, 1 Hr , 8 Hrs & 24 Hrs] as shown in the above snapshot shall be implemented.

Type	Name	Tag Id	Data Range (Min / Max)	Event
Trend Graph & Live dB Values	Channel 1 to 10 (repeat for other screens)	200 to 239	NA	NA
Button	Left Arrow Below Graph	Previous Trend Screen [Cyclic]	NA	NA
Button	Right Arrow Below Graph	Next Trend Screen [Cyclic]	NA	NA

**5.0 Mimic Screen:**



## BHELSONIC 20i HMI INTERFACE DEVELOPMENT

REF: BS20i-HMI-R1

12.02.2022

### Mimic Screen:

- 5.1 This screen shows the Actual Physical Location of the sensors in boiler and their current dB values.
- 5.2 The position shall be placed based on the general arrangement drawing provided by BHEL Trichy.
- 5.3 Default color of the Sensor is Grey.
- 5.4 Highlight with **Red color With blinking** if the leak is detected.
- 5.5 Leak detected shall be decided using the Bit No. **1** of Corresponding Tag # 260 to 299.

Type	Name	Tag Id	Data Range (Min / Max)	Event
dB Display	Channel #01 to #40	200 to 239	NA	On mouse over/ Click sensor, location shall be displayed as provided in the table

ITEM NO.	LOCATION OF OPENINGS		LEFT / RIGHT
S01	BETWEEN BOTTOM ROW OF WW SB		LEFT
S02			RIGHT
S03			LEFT
S04			RIGHT
S05	ABOVE TOP COAL BURNER		LEFT
S06			RIGHT
S07			LEFT
S08			RIGHT
S09	BOTTON OF DIVISION PANELLETTE		LEFT
S10			RIGHT
S11	BEFORE SH PLATEN		LEFT
S12			RIGHT
S13	PENTHOUSE AREA	NEAR SH PLATEN HEADER	LEFT
S14		NEAR FINAL SH FRONT & REAR HEADERS	RIGHT
S15			LEFT
S16	BETWEEN FINAL RH & WW SCREEN / HANGERS		RIGHT
S17			LEFT
S18	NEAR LTRH HANGER		RIGHT
S19			LEFT
S20	ABOVE LTRH HORIZONTAL		RIGHT
S21			LEFT
S22	BETWEEN LTRH INTERMEDIATE UPPER & LOWER		RIGHT
S23			LEFT
S24			RIGHT
S25			LEFT
S26	BETWEEN ECONOMISER LOWER & UPPER BANKS		RIGHT
S27			LEFT
S28			RIGHT
S29			LEFT
S30	FRONT WATER WALL PANEL BELOW ROOF		FRONT

## 6.0 Sensor Profile:



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

### **Sensor Profile**

- 6.1 This menu is used to show the profile information and healthiness of the selected sensor (on the top right);
- 6.2 Default Startup Sensor number shall be 01 and Shall be cyclic between min (1) and SensorCount.
- 6.3 The left and right arrow shall be used for selecting the sensor.
- 6.4 Selected Sensor shall be highlighted in the mimic display [ Top Left Image]
- 6.5 Option to type in the sensor number directly in the text box shall also be provided. [Use NumPad – Alphabets not accepted]
- 6.6 Pressing Button - Sensor Settings shall navigate to Sensor Settings Screen.

Type	Name	Tag Id	Data Range (Min / Max)	Event
Text Box (between arrow)	Channel No	9	1 to SensorCount	Default on Startup Value = 1
Button	Left Arrow	9	1 to SensorCount	Decrement Tag #9 value by 1. If the value of Tag#9 =0, then, set Tag#9 to SensorCount
	Right Arrow	9	1 to SensorCount	Increment Tag #9 value by 1. If the value of Tag#9 > SensorCount, then, set Tag#9 to 1
	Sensor Settings	Navigate to Sensor Setting Page	NA	
Map	dB Values of each Channel	200 to 239	NA	
Label	Sensor Details Ch#	9	NA	
	Sensor Id	73	NA	
	Serial No	70	NA	
	Sensor Type	71	NA	

**BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

	Firmware Version	72	NA	
	Current dB	11	NA	
	Location	74, 75, 76	NA	
	Temperature	10	NA	
Label	Uptime	113 to 120 (for date label)	NA	Read as String : Format dd/mm/yy hh:mm:ss
	Uptime Count	126	NA	
	Calibration	86 to 94 (for date label)	NA	Read as String: Format dd/mm/yy hh:mm:ss
	Calibration Count	123	NA	
	Last Purge	77 to 85 (for date label)	NA	Read as String : Format dd/mm/yy hh:mm:ss
	Purge Count	122	NA	
	Last Error	95 to 103 (for date label)	NA	Read as String : Format dd/mm/yy hh:mm:ss
	Error Count	124	NA	
	Last Leak	104 to 112 (for date label)	NA	Read as String : Format dd/mm/yy hh:mm:ss
	Leak Count	125	NA	
Radio Button  Tag Id 12	Comm. Fail	Bit No 12	NA	
	Cal. Required	Bit No 3	NA	

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1  
12.02.2022

	Cal Error	Bit No 5	NA	
	Purge Required	Bit No 6	NA	
	Purge Error	Bit No 8	NA	
	Self Test Error	Bit No 11	NA	
	Healthiness	Bit No 0	NA	
	Leak Detected	Bit No 1	NA	
	Calibrating	Bit No 4	NA	
	Purging	Bit No 7	NA	
	Self Test Progress	Bit No 10	NA	
Dial Display	Current dB Value of selected sensor	11	NA	
Button Tag Id. : 13	Self Test	Set Bit No 0	NA	Read & Write Tag
	Purge	Set Bit No 1	NA	Read & Write Tag
	Listen	Set Bit No 4	NA	Read & Write Tag
Radio Button Tag. Id. : 12	Near Self-Test Button	Bit No 10	NA	
	Near Purge Button	Bit No 7	NA	
	Near Listen Button	Bit No 13	NA	



## BHELSONIC 20i HMI INTERFACE DEVELOPMENT

REF: BS20i-HMI-R1  
12.02.2022

### 7.0 SENSOR SETTINGS:

The screenshot displays the 'SENSOR SETTINGS' screen of the BHELSONIC 20i HMI. The interface is divided into several sections:

- Frequency band wise Threshold settings (dB):** A table with 32 rows and 2 columns, allowing users to set thresholds for each frequency band. All values are currently set to 0.
- Sensor alarm settings:** Two input fields for 'Alarm threshold (dB)' and 'Delay setpoint (s)', both set to 0.
- Nominal sound level:** Two input fields for 'Lower limit (dB)' and 'Upper limit (dB)', both set to 0.
- Reset:** A section containing six buttons: 'Purge log', 'Cal log', 'Power log', 'Error log', 'Leak log', and 'All logs'.
- Action Buttons:** Two large buttons at the bottom right: 'Save settings to sensor' and 'Copy settings to all sensors'.
- Navigation and Status:** At the bottom, there are navigation buttons (back, home, forward) and a timestamp '07/04/20 - 11:42:16'.

Frequency band wise Threshold settings (dB):	
Freq. Band 01	0
Freq. Band 02	0
Freq. Band 03	0
Freq. Band 04	0
Freq. Band 05	0
Freq. Band 06	0
Freq. Band 07	0
Freq. Band 08	0
Freq. Band 09	0
Freq. Band 10	0
Freq. Band 11	0
Freq. Band 12	0
Freq. Band 13	0
Freq. Band 14	0
Freq. Band 15	0
Freq. Band 16	0
Freq. Band 17	0
Freq. Band 18	0
Freq. Band 19	0
Freq. Band 20	0
Freq. Band 21	0
Freq. Band 22	0
Freq. Band 23	0
Freq. Band 24	0
Freq. Band 25	0
Freq. Band 26	0
Freq. Band 27	0
Freq. Band 28	0
Freq. Band 29	0
Freq. Band 30	0
Freq. Band 31	0
Freq. Band 32	0

**Sensor alarm settings:**  
Alarm threshold (dB) 0  
Delay setpoint (s) 0

**Nominal sound level:**  
Lower limit (dB) 0  
Upper limit (dB) 0

**Reset:**  
Purge log Cal log Power log  
Error log Leak log All logs

**Action Buttons:**  
Save settings to sensor Copy settings to all sensors

07/04/20 - 11:42:16

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

### **SENSOR SETTINGS:**

- 7.1 This menu is used to set the sensor parameter of the selected sensor (on the top right);
- 7.2 Default Startup Sensor number shall be 01 and Shall be cyclic between min and SensorCount.
- 7.3 The left and right arrow shall be used for selecting the sensor.
- 7.4 Option to type in the sensor number directly in the text box shall also be provided. [Use NumPad – Alphabets not accepted]
- 7.5 The Freq Band Value shall take values from user and display. [Only NumPad Entry]

Type	Name	Tag Id	Data Range (Min / Max)	Event
Freq. Band 01 - 32	Frequency Set Point #01 to #32	146 to 177	60 to 120	Read & Write Tag
Text Box (between arrow)	Channel No	9	1 to SensorCount	Default on Startup Value = 1
Button	Left Arrow	9	1 to SensorCount	Decrement Tag #9 value by 1. If the value of Tag#9 =0, then, set Tag#9 to SensorCount
	Right Arrow	9	1 to SensorCount	Increment Tag #9 value by 1. If the value of Tag#9 > SensorCount, then, set Tag#9 to 1
Alarm Threshold dB		130	60 to 120	Read & Write Tag
Delay Setpoint in secs		131	30	Read & Write Tag
Lower Limit dB		132	40 to 60	Read & Write Tag
Upper Limit dB		133	100 to 120	Read & Write Tag

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1  
12.02.2022

Button	Purge Log	454	Set Bit 0	Read & Write Tag
	Cal Log	454	Set Bit 1	Read & Write Tag
	Power Log	454	Set Bit 2	Read & Write Tag
	Error Log	454	Set Bit 3	Read & Write Tag
	Leak Log	454	Set Bit 4	Read & Write Tag
	All Logs	454	Set Bit 5	Read & Write Tag
	Save Settings to Sensor	179		Read & Write Tag
	Copy Settings to All Sensor	178		Read & Write Tag

## BHELSONIC 20i HMI INTERFACE DEVELOPMENT

REF: BS20i-HMI-R1  
12.02.2022

### 8.0 SYSTEM SETTING:

**Maintenance**  
Calibration interval   
(Days)  
Purge interval (Days)   
Purge duration (sec)

**Digital Outputs:**  
☐ Alarm  
☐ Purging  
☐ Error  
☐ Spare

**Digital Inputs:**  
☐ Alarm Inhibit  
☐ Auto Purging ENABLED  
☐ Power Status 1  
☐ Power Status 2

**No. of Sensors : 0**  
**Sensor Mapping :**  
[ 0-Not Connected 1-COM1 2-COM2 ]


Ch#01	<input type="text" value="0"/>	Ch#02	<input type="text" value="0"/>	Ch#03	<input type="text" value="0"/>	Ch#04	<input type="text" value="0"/>
Ch#05	<input type="text" value="0"/>	Ch#06	<input type="text" value="0"/>	Ch#07	<input type="text" value="0"/>	Ch#08	<input type="text" value="0"/>
Ch#09	<input type="text" value="0"/>	Ch#10	<input type="text" value="0"/>	Ch#11	<input type="text" value="0"/>	Ch#12	<input type="text" value="0"/>
Ch#13	<input type="text" value="0"/>	Ch#14	<input type="text" value="0"/>	Ch#15	<input type="text" value="0"/>	Ch#16	<input type="text" value="0"/>
Ch#17	<input type="text" value="0"/>	Ch#18	<input type="text" value="0"/>	Ch#19	<input type="text" value="0"/>	Ch#20	<input type="text" value="0"/>
Ch#21	<input type="text" value="0"/>	Ch#22	<input type="text" value="0"/>	Ch#23	<input type="text" value="0"/>	Ch#24	<input type="text" value="0"/>


**Communication Settings:**  
NFC timeout (sec)   
RS485 timeout (sec)



**Sensor settings**

**Self Test all sensors**

**Save settings**







07/04/20 - 10:50:42

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

12.02.2022

8.1 This menu is used to setup the system configuration for the complete system.

8.2 There are 5 sub-groups inside the system setting namely:

- I. Maintenance
- II. Digital Outputs
- III. Digital Inputs
- IV. Communication Setting
- V. Sensor Mapping

Type	Name	Tag Id	Data Range (Min / Max)	Event
Maintenance Numeric Input Fields	Calibration Interval (days)	335	30 to 180	Read & Write Tag
	Purge Interval (days)	334	30 to 180	Read & Write Tag
	Purge Duration (sec)	333	10 to 60	Read & Write Tag
LED Status for Digital Outputs	Alarm	451 bit no 0		Read Only
	Puring	451 bit no 1		Read Only
	Error	451 bit no 2		Read Only
	Spare	451 bit no 3		Read Only
LED Status for Digital Inputs	Alarm Inhibit	450 bit no 0		Read Only
	Auto Puring Enabled	450 bit no 1		Read Only

## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1

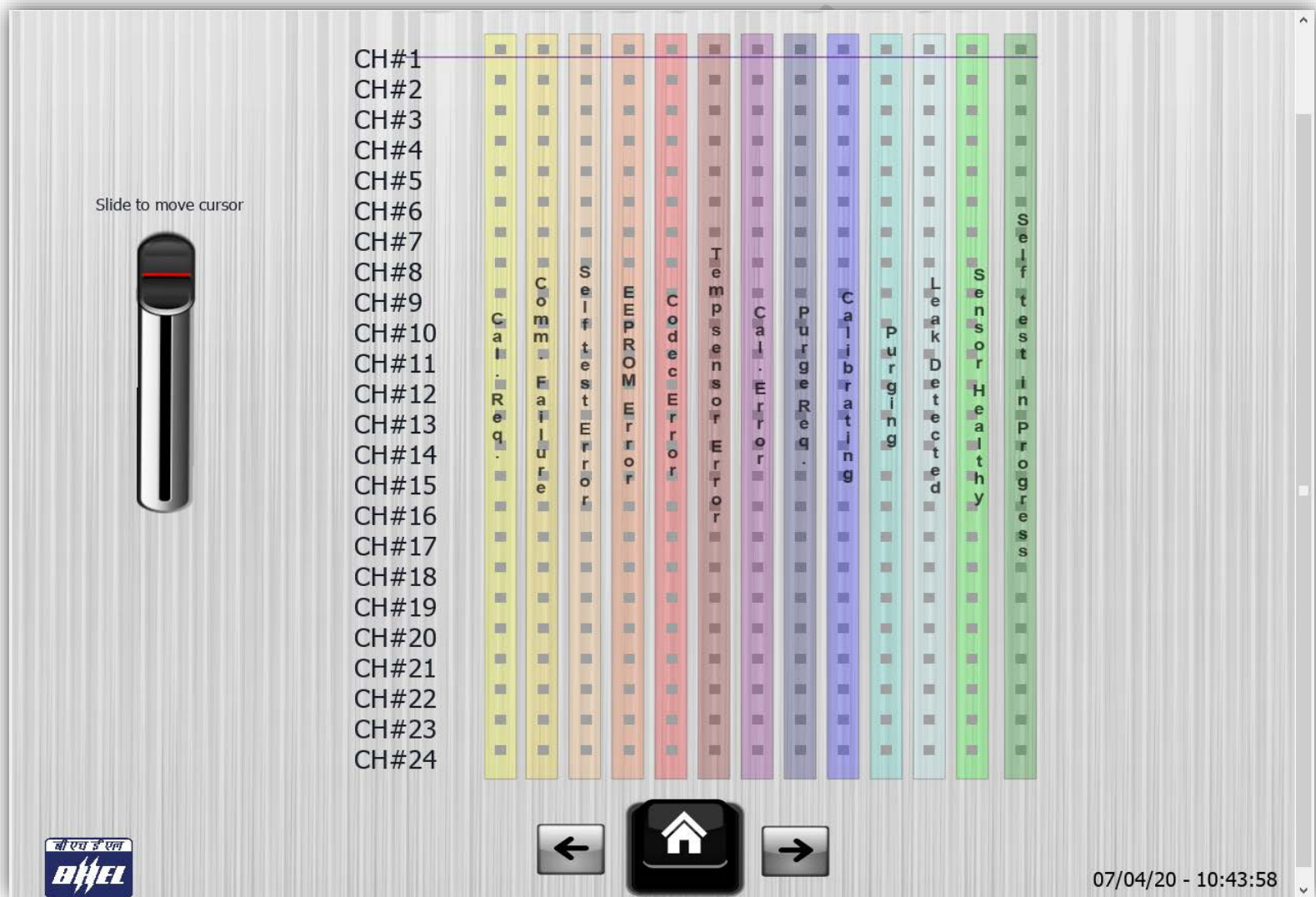
12.02.2022

	Power Status 1	450 bit no 2		Read Only
	Power Status 2	450 bit no 3		Read Only
Communication Settings	NFC TimeOut (sec)	336		Read & Write Tag
	RS485 TimeOut (sec)	337		Read & Write Tag
Sensor Mapping	No. of Sensors [Label]	371		Read Only
	Sensor Mapping 01 –to– Sensor Count	372 to 411	1 or 2	Number of the fields shall be corresponding to the Sensor Count. Snapshot shown for 24 Channels.
Buttons	Sensor Settings	Move to Sensor Settings menu		
	Save Settings	540		Read & Write Tag
	Self Test All Sensors	452		Read & Write Tag

**REF: BS20i-HMI-R1**

**12.02.2022**

## 9.0 Sensor Status:



## **BHELSONIC 20i HMI INTERFACE DEVELOPMENT**

REF: BS20i-HMI-R1  
12.02.2022

### **Sensor Status:**

- 9.1 This menu is used to display status of all the channels
- 9.2 No of channels shall be based on the Sensor Count for the project but limited to **half of the SensorCount** per screen.
- 9.3 Mouse over of the Channel number shall show a Horizontal line for better readability of the data presented.

---

*For Projects having more than 20 sensors – The number of sensors in the screen shall be suitable split across.  
Instance, 34 number of sensors shall be split to 17 x 2 screens.*

---

Type	Name	Tag Id	Data Range	Event
	Cal. Req.	Bit 3	Not Applicable	Choose 260 to 299 based on the sensor number in sequence
	Comm. Fail.	Bit 12		
	Self Test Error	Bit 11		
	EEPROM Error	Bit 14		
	Codec Error	Bit 15		
	Calibrator Error	Bit 5		
	Purge Req.	Bit 6		
	Calibrating	Bit 4		
	Purging	Bit 7		
	Leak Detected	Bit 1		

**- End of Document -**