IHH500 Product Manual

Sensor Solution Source
Load · Torque · Pressure · Multi Axis · Calibration · Instruments · Software

www.futek.com

ISO
9001:2008

ISO
17025:2005

U.S. Manufacturer

Table of Contents

1   Receiving & Unpacking

1.1   Unpacking

Check all parts to ensure no damage was done during transit. If you suspect that your product is damaged, contact FUTEK at futek@futek.com for immediate support.

1.2   Storage

If the device is to be stored for a prolonged period, take the following safety precautions:
- The storage temperature should be between 0°C and +70°C (32°F to 158°F).
- Cover all connectors with dust protection caps.
- Store in a dry environment.
- If possible, store the instrument in its original packaging when not in use.

1.3   Accessories Supplied

- Battery charger with US plugs (2 pin connector)
- Dust protection caps

1.4   Optional Accessories

- USB Cable   (4 pin connector)
- Output Cable   (8 pin connector)
- Sensor Cable   (12 pin connector)

Caution
FUTEK is not responsible for any damage or injury caused by misuse, misunderstanding, or abuse of this product.

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2 Safety Considerations & Care for Your Device

- Do not disassemble for modifications or repair
- Be sure to disconnect the power cable and turn the device off when connecting or disconnecting any of the connectors
- Do not operate the device in the following environments:
  - Direct sunlight
  - Where the product will be splashed with water, oil, and chemicals
- Do not throw, drop, or scratch with any sharp objects
- In order to extend the built-in lithium battery life the intelligent battery charger circuit has different curves:
  - **Fast charge**: after 2 hours the battery will be charged around 60%
  - **Normal charge**: It takes about 6-7 hours to charge the battery around 90%
  - **Slow charge**: it takes about 10 hours for fully charging the battery
    - It is recommended to use the **slow charge** at least once a week
    - Always use the FUTEK supplied charger to charge the battery
- Use the dust protection caps to cover the connectors when you are not using the device.

3   Important Information for IHH500

3.1   Performance

The IHH500 is a microcontroller based digital handheld instrument that monitors the activity of a vast range of sensors. This includes Wheatstone bridge strain gauge and amplified output Torque/ Force/ Pressure/ Displacement sensors. All of the measurements are based on a high accuracy, low noise, 24 bit resolution Analog to Digital Converter with a non-linearity of 0.001% and a temperature coefficient factor of less than 5 PPM (zero and span drift). All analog components not only those ones that provide the requirements for ADC such as reference voltage but also the ones which are employed for analog output, excitation voltage and input/output buffers are low noise, low distortion, low temperature coefficient, and high precision/accuracy parts. The combination of these components, along with a high speed micro-controller integrated with a precision DAC controller has provided a high accuracy instrument, which is able to measure the activity of a 2 mV/V sensor with up to a 500,000 count (total) noise free base! The high precision DAC controller has been exploited to provide a ± 5 V voltage output with 100 μV resolution and/or (0-25mA) current output with a 0.5 μA resolution. A wide range of bridge resistances and input/output impedances of external instruments can be applied to this device without any lack of performance.

The IHH500 accepts amplified Voltage input (± 12 VDC), Current input (up to 30mA), Bridge input (up to 500 mV/V), and Pulse/ TTL input (up to 650,000 pulses per second) and has the capability to provide power to FUTEK rotary torque sensors (24 VDC/ 1 W and 5 VDC/ 0.05 W).

3.2   Product Introduction

- TEDS IEEE 1451.4 compliant with template 30 for High level voltage output sensors and template 33 for bridge sensors
- Ability to interact with TEDS data by using the SENSIT Test and Measurement software
- Selectable calibration method including live calibration by applying the actual load or manipulating method by entering the sensitivity
- Ability to measure bridge resistance
- Automated sensitivity calculation based on calibration value
- Dual scaling calculation for bi-directional sensors
- Selectable units of measure for Force, Torque or Pressure and Displacement with automatic conversion of units between readings
- Selectable sampling rate from 5 samples per second to ultra-fast signal sampling rate of 4800 samples per second in 16 different speeds
- Selectable moving average method for software filtering
- Peak/ Valley and First Peak/ First Valley functions
- Manual and auto peak/valley reset functions
- Tare/ Gross functions with indicator
- Tracking/Hold functions with indicator
- Built-in shunt calibration features with indicator

- Lockout feature to prevent inadvertent changes
- Data logging with up to 21,000 points
- Supports USB link port
- Built-in load cell excitation voltage
- Powered by a rechargeable 3000 mAh lithium-polymer battery for up to 24 hours of operation.
- Battery/ life indicator with bar graph and text indicators
- Selectable automatic display shutoff for period of inactivity (up to 15 minutes)
- Selectable latched or non-latched alarm configuration
- ASCII Stream Output
- Two independently isolated solid state alarm relays, each able to be disabled or enabled individually, with normally open or closed operations and protected at 110mA/110V
- Selectable voltage output as bipolar (± 5 V) or uni-polar (0-5V) with 2.5V offset
- Selectable current output as bidirectional and unidirectional
- Selectable 0-20mA, 0-25mA, 4-20mA, 5-25mA current output
- Selectable alarm configuration (Latched or non-Latched)
- Supports Speed (RPM), Angle (Degrees), and Power (W/kW/MW/HP) measurements for rotary torque sensors with encodes
- Provides a +5.000 V (±1 mV) excitation voltage to bridge resistances as low as 30 Ohms and as high as 30k Ohms with a limited current to 160 mA
- Default channel calibrated to 0-4 mV/V using precision BLH
- Back lit 4x16 character LCD with selectable brightness, contrast, and auto shut off
- Selectable digit height size (4.7 mm and 12.7mm)
- Selectable number of digits to be displayed, excluding the decimal point (3, 4, 5, or 6)
- Equipped with the diagnostic mode to measure bridge resistance, sensitivity, internal voltage (Analog and digital), battery and temperature
- User friendly navigation menu directs users to enable/disable or select/unselect various features with easy to follow instructions
- Ability to store 14+1 sensor profiles including calibration values such as Offset, Full scale, Loading point(s) , Engineering unit , Serial number, Sensor type (Bridge, Voltage , Current, Pulse) , Sensitivity, Alarm limits (High and Low) and all Peak/ Valley (First, Hold, Auto reset) Threshold values
- Active channel number indicator
- IP66 housing and connectors
- Aluminum enclosure
- Lead free/ RoHS compliant parts
- ESD, EMI, EFT and short circuit protected Input and output which covers the CE approval

Note: IHH500 is available in two versions, Elite and Pro.

4 Connector & Wiring Diagram

Connectors	Description			Diagram (Female Insert)
Sensor Connections	Pin A B C D E F G H J K L M	Symbol +E +S -E -S TEDS_IO 24_OUT GND_OUT 5_OUT -V +V PLEAD PLAG	Description +Excitation +Signal -Excitation, TEDS return -Signal TEDS Data 24V output Ground 5V Output -V from sensor +V from sensor Leading Pulse from sensor Lagging Pulse from sensor	
Output Connections	Pin 1 2 3 4 5 6 7 8	Symbol IDAC REFRENCE +R1 VDAC +R2 GND -R1 -R2	Description analog current output signal analog voltage output return solid state relay1 (positive) analog voltage output signal solid state relay2 (positive) analog current output return solid state relay1 (negative) solid state relay2 (negative)	
USB port Connections	Pin 1 2 3 4	Symbol VBUS -D +D GND		
Power Connections	Pin 1 2 (Note: These pins are not polarity sensitive)	Symbol 12V Ground		

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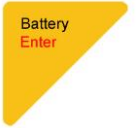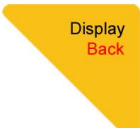
5 Features

5.1 IHH500 Overview

USB   Output

Power

Sensor

16x4 Character LCD

Peak Value

Tracking

Valley Value

Active Channel Number

Sampling rate

Battery Indicator

Larger Font Display Options

Menu

Tare/ Gross

Peak/Valley Reset

Unit

Navigation Keys

Track/ Hold

Shunt Calibration Verification

Power Key

Dust Protection Caps- IP67

Submersible Aluminum Enclosure

4.00"

Tactile Membrane Switches

Adjustable Mount

Bumpons on back

IHH500

FUTEK ADVANCED
SENSOR TECH INC.
IHH500 - ELITE
MADE IN USA

Battery Enter   Tare Gross   Display Back

Reset   Menu   Unit

Exit Shunt   Track Hold   Power

6.00"

1.65"

2.03"

1.55"

In the welcome message of the Pro version, "PRO" will be displayed.
Above it is shown that the IHH500 is submersible

Front Panel Button	Function of Button in Menu Mode	Function of Button in Normal Mode
Battery Enter	Enter	Displays battery life time
Tare Gross	▲ Arrow	Allows the user to toggle between displaying the tare and gross values. This can be used to remove any fixture weights.
Display Back	Back	Allows the user to toggle between two different size fonts. This key selects one of the four different states in normal mode and one of the five different states when a rotary sensor with an encoder is being monitored. In this case rpm, torque, angle and power will be displayed.
Reset	◄ Arrow	Allows the user to reset the peak/ valley or angle (in rotary sensors with an encoder)
Menu	N/A	Start navigation
Unit	► Arrow	Allows the user to toggle between four groups of engineering units (Force, Torque, Pressure, and Displacement) and the standard mV/V.[1]
Exit Shunt	Exit	Allows the user to shunt the current reading. The device shunts a resistor across the -Excitation and -Signal connections.[2]
Track Hold	▼ Arrow	Allows the user to freeze the current reading. HOLD will be displayed on the LCD showing that it has been held. When the button or any other key is pressed, the hold command will be cancelled.[2]
Power	ON/OFF	ON/OFF

[1] Engineering units can only be converted within its own category.

Force (Mass): µg, mg, g, kg, M- tone, dyn, kdyn, Mdyn, N, kN, oz, lbs, klb, ton (US), ton (UK)
Torque: g-mm, g-cm, kg-cm, kg-m, N-mm, N-cm, N-m, KN-m, in-oz, in-lb, ft-lb
Pressure: Pa, kPa, mbar, bar, MPa, kg/cm², atm (standard atmosphere), mm-HG, in-H2O, ft-H2O, psi, kpsi
Displacement: mm, cm, dm, m, km, in, ft, yds, mile

[2] Pressing SHUNT will disable the HOLD function, but pressing HOLD will not disable the SHUNT function.

Note: When a torque sensor is configured, the HOLD and SHUNT keys are disabled on the main page showing the speed, angle and torque. Using the HOLD and SHUNT keys will prompt a warning message.

5.2 IHH500 Structure

```
                              ┌─────────────┐
                              │     USB     │
                              └─────────────┘
                                     ↕
┌──────────────┐              ┌─────────────┐              ┌──────────────┐
│     TEDS     │ ←──────────→ │             │ ──────────→  │ ASCII Output │
├──────────────┤              │             │              ├──────────────┤
│ Bridge Input │ ──────────→  │             │ ──────────→  │Current Output│
├──────────────┤              │    MCPU     │              ├──────────────┤
│ Pulse Input* │ ──────────→  │             │ ──────────→  │Voltage Output│
├──────────────┤              │             │              ├──────────────┤
│Voltage Input │ ──────────→  │             │ ──────────→  │Alarm Relay 1 │
├──────────────┤              │             │              ├──────────────┤
│Current Input │ ──────────→  │             │ ──────────→  │Alarm Relay 2 │
└──────────────┘              └─────────────┘              └──────────────┘
      ↑                              ↕                            ↑
┌──────────────┐              ┌─────────────┐              ┌──────────────┐
│   Key Pad    │ ←──────────→ │  Hardware   │ ←──────────→ │   Display    │
│              │              │ Controller  │              │    (LCD)     │
└──────────────┘              └─────────────┘              └──────────────┘
      ↑                ↑             ↑              ↑
┌──────────────┐ ┌─────────────┐ ┌──────────┐ ┌──────────────┐
│Input Protection│ │Battery Charger│ │Power Supply│ │Output Protection│
└──────────────┘ └─────────────┘ └──────────┘ └──────────────┘
```
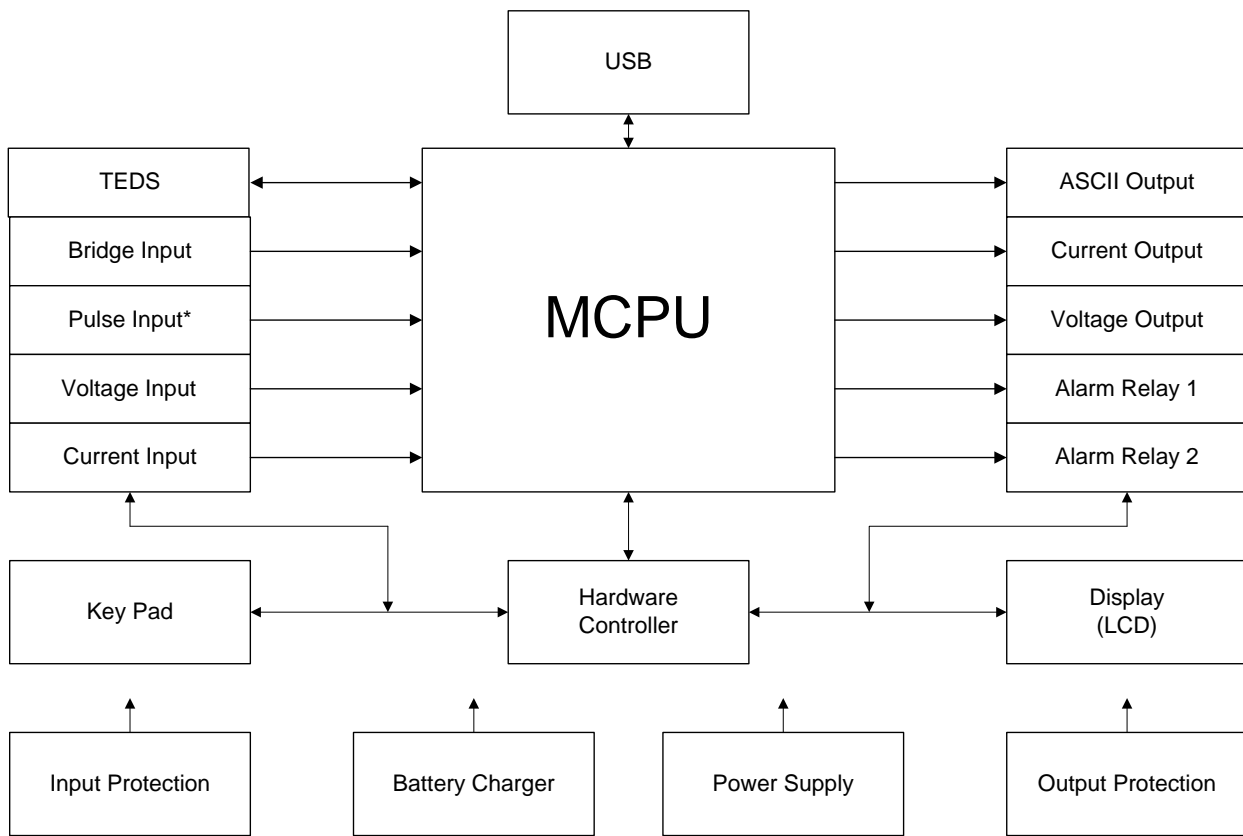
* Available only in Elite Version.

5.3   Main Display

```
   FUTEK ADVANCED
  SENSOR TECH INC.
    IPM650-PRO
    MADE IN USA
```

Welcome message will be displayed at power on

```
  AUTO CALIBRATION

    IN PROGRESS

  PLEASE WAIT   11

       ....
```

Auto calibration will be applied when device is turned on. The calibration will minimize any effects of the temperature drift for either zero (offset) or span. During the auto calibration process the key pad is locked out and inaccessible. Brief information about the active channel will be displayed when calibration is complete.

Depending on whether TEDS detect is enabled or not (see section 6.8.4), the following Sensor Profile will be displayed for 10 seconds: TEDS enabled (left), TEDS disabled (right).

```
TEMPLATE      33
SERIAL    123456
20.0000      LBS
1.98765     mV/V
```

```
CHANNEL       01
SERIAL         1
SENSOR    BRIDGE
+2.00000    mV/V
```

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After 10 seconds the following message will be displayed.

```
+2.00001     Peak
+2.00000     mV/V
+1.99999   Valley
01 Gross  5   SPS
```
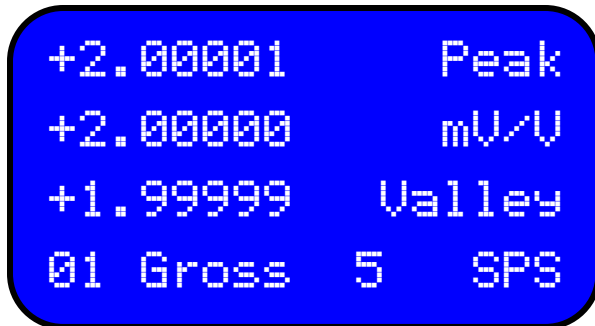
Pressing the display key will change the reading to a larger font. Pressing it again will switch between modes while still in the large font. The tare and gross modes can also be used while in the larger font mode.

```
PK
 +2.00001
 01  GROSS       mV/V
```

```
PK
 +0.00001
 01  TARE        mV/V
```

```
TR
 +2.00000
 01  GROSS       mV/V
```

```
TR
 +0.00000
 01  TARE        mV/V
```

```
VY
 +1.99999
 01  GROSS       mV/V
```

```
VY
 -0.00001
 01  TARE        mV/V
```

```
+2.0000        Peak
+2.00000        mV/V
+1.99999      Valley
01  Gross       5SPS
```

After displaying the Valley, the next change will direct you to the main page again.

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For rotary torque sensors, the following screen will be displayed before returning to the main screen.

NOTE: To monitor Torque, Speed, Angle, and Power on the SENSIT Test and Measurement software during live graphing, the screen of IHH500 should be changed by pressing the "DISPLAY" key. The following screen will be displayed:

```
+60000        RPM
+400          N-m
+1800         DEG
+2513.27      KW
```
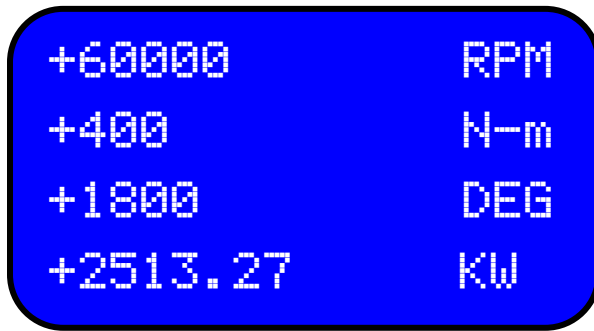
If an incorrect unit (other than torque) has been selected for a rotary torque sensor, an error message will be displayed on the last row.
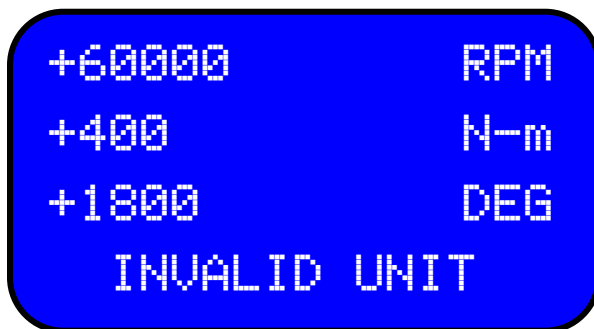
```
+60000        RPM
+400          N-m
+1800         DEG
   INVALID UNIT
```

Note: When a torque sensor is configured, the HOLD and SHUNT keys are disabled on the main page showing the speed, angle and torque. Using the HOLD and SHUNT keys will prompt a warning message.

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The shunt key can be pressed any time after the device has been calibrated and a new sensor profile has been loaded. The simulated value is to be used as a calibration reference. SHUNT will blink on the display when enabled.

```
+3.03461      Peak
+3.03460      mV/V
+1.59484    Valley
01 Gross     SHUNT
```
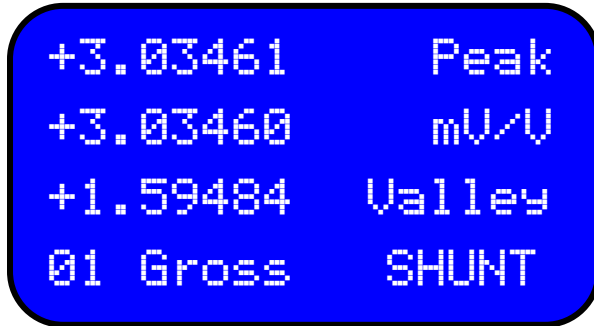
When both SHUNT and HOLD are active on the last row, the display will switch between blinking SHUNT and blinking HOLD.

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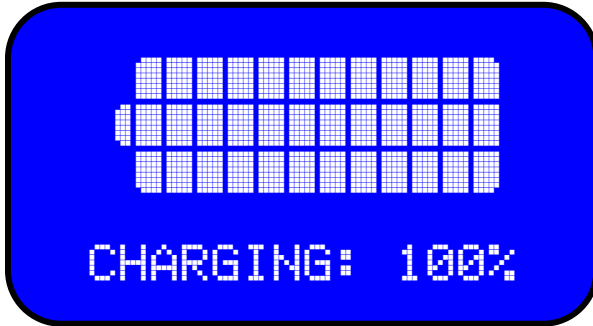
CHARGING: 100%

The Battery key will allow you to view the battery life time.
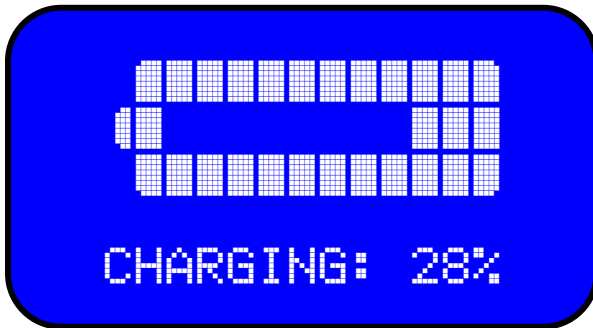
CHARGING: 28%

Pressing the battery button while the charger is plugged in will display a battery charging screen.

BATTERY LOW!
CONNECT THE
BATTERY CHARGER
TO THE DEVICE
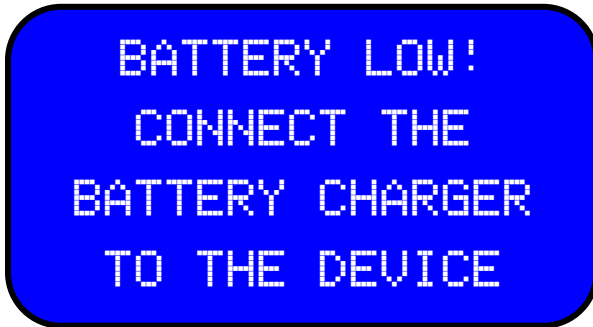
Whenever the battery level drops below 6.5V, a warning message will be displayed.

BATTERY FULL!
YOU CAN UNPLUG
BATTERY CHARGER
FROM THE DEVICE
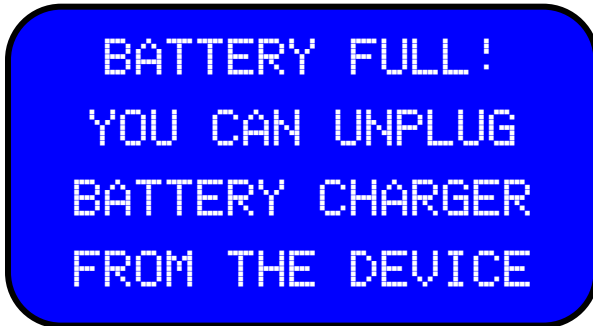
Whenever the battery level exceeds 8V and the charger is connected, a warning message will be displayed.

There are two pulse signals, P1 and P2, which are used to indicate speed, angle, power, and the direction of rotation. These pulses are 90 degrees out of phase, and depending on which pulse is leading or lagging or how many pulses are present in a certain time frame, the IHH500 can calculate these values.

Leading, TTL

Lagging, TTL
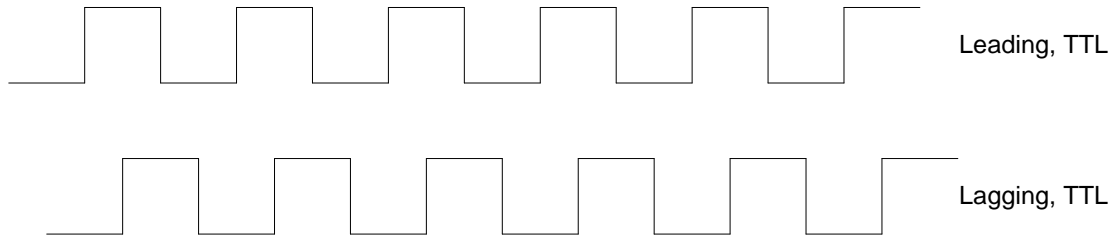
<u>Calculation of Power:</u>
Power is calculated by using the following formula:

$$P = T \times N = \frac{T \times 2\pi \times RPM}{60000}$$

Where:

P: mechanical power in kW
T: torque in N-m
RPM: speed in rev / min

Calculating the Power Units:

- If the **g-mm, g-cm, g-m** or **N-mm** units have been defined, the mechanical power is automatically calculated in **W**
- If the **kg-cm, kg-m,** or **N-m** units have been defined, the mechanical power is automatically calculated in **kW**
- If the **kN-m** unit has been defined, the mechanical power is automatically calculated in **MW**
- If the **In-Ib, oz-in** or **ft-Ib** units have been defined, the mechanical power is automatically calculated in **HP**

<u>Direction of Rotation:</u>
Since there are two pulses, a direction of rotation (CW or CCW) can be defined depending on which pulse is leading.

Calculation of Speed:

The input frequency that can be evaluated for recording the speed is used in defining the speed. The input speed based on the pulses per rotation can be calculated as follows:

$$N = \frac{f \times 60}{PPR}$$

Where:

    N: Speed (RPM)
    f: Frequency
    PPR: User-defined pulses per rotation (selectable up to 9999)

Angle calculation:

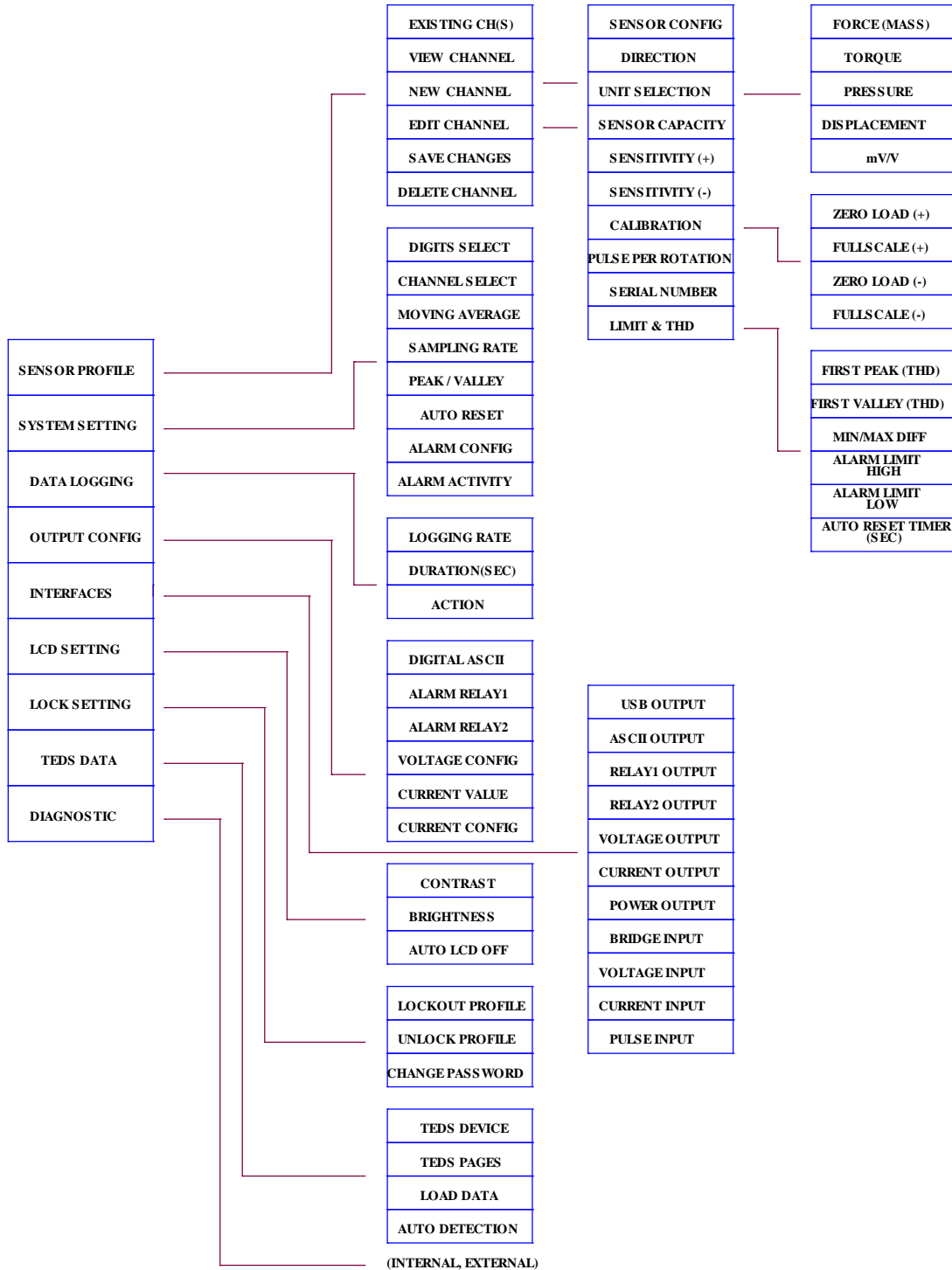After calculating the Angle will be computed based on pulse per rotation.

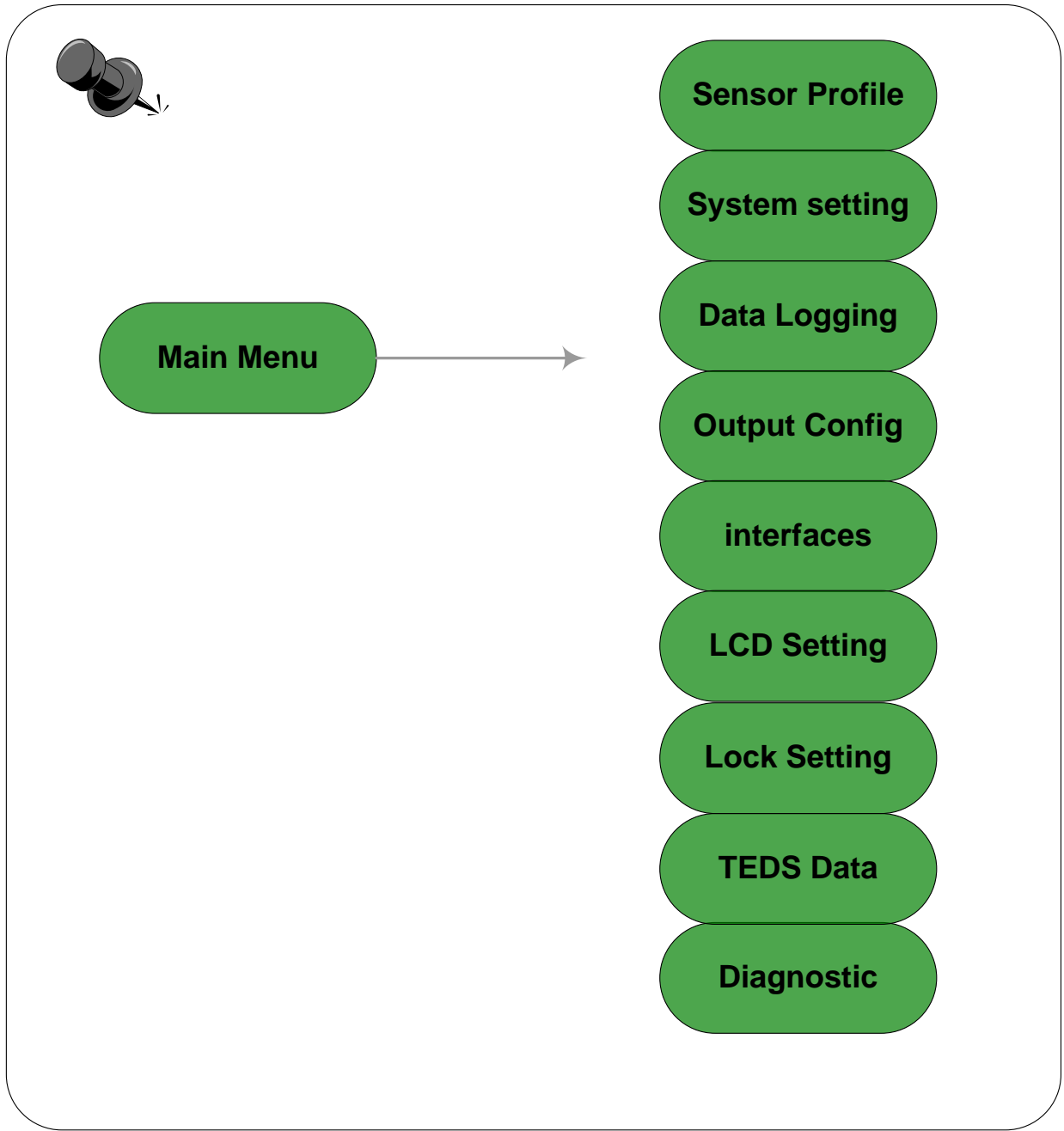$$\alpha = \frac{RPM}{60} \times PPR$$

Where:

    RPM: Revolution per Minute
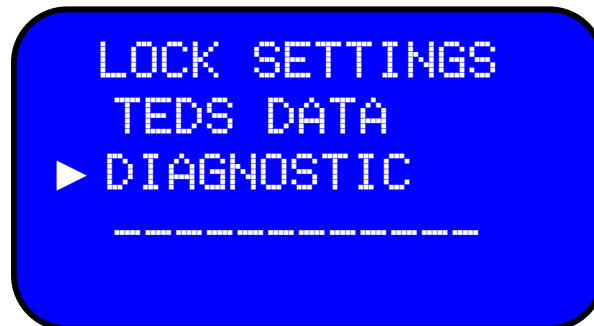   *PPR*:   Pulse per Rotation
    α: Angle

Note: the resolution of Angle calculation is 1 degree.

6 Main Menu Overview

EXISTING CH(S)	**SENSOR CONFIG**	**FORCE (MASS)**
VIEW CHANNEL	**DIRECTION**	**TORQUE**
NEW CHANNEL	**UNIT SELECTION**	**PRESSURE**
EDIT CHANNEL	**SENSOR CAPACITY**	**DISPLACEMENT**
SAVE CHANGES	**SENSITIVITY (+)**	**mV/V**
DELETE CHANNEL	**SENSITIVITY (-)**	

CALIBRATION	**ZERO LOAD (+)**
PULSE PER ROTATION	**FULLSCALE (+)**
SERIAL NUMBER	**ZERO LOAD (-)**
LIMIT & THD	**FULLSCALE (-)**

DIGITS SELECT
CHANNEL SELECT
MOVING AVERAGE
SAMPLING RATE
PEAK / VALLEY
AUTO RESET
ALARM CONFIG
ALARM ACTIVITY

FIRST PEAK (THD)
FIRST VALLEY (THD)
MIN/MAX DIFF
ALARM LIMIT HIGH
ALARM LIMIT LOW
AUTO RESET TIMER (SEC)

SENSOR PROFILE
SYSTEM SETTING
DATA LOGGING
OUTPUT CONFIG
INTERFACES
LCD SETTING
LOCK SETTING
TEDS DATA
DIAGNOSTIC

LOGGING RATE
DURATION(SEC)
ACTION

DIGITAL ASCII
ALARM RELAY1
ALARM RELAY2
VOLTAGE CONFIG
CURRENT VALUE
CURRENT CONFIG

USB OUTPUT
ASCII OUTPUT
RELAY1 OUTPUT
RELAY2 OUTPUT
VOLTAGE OUTPUT
CURRENT OUTPUT
POWER OUTPUT
BRIDGE INPUT
VOLTAGE INPUT
CURRENT INPUT
PULSE INPUT

CONTRAST
BRIGHTNESS
AUTO LCD OFF

LOCKOUT PROFILE
UNLOCK PROFILE
CHANGE PASSWORD

TEDS DEVICE
TEDS PAGES
LOAD DATA
AUTO DETECTION
(INTERNAL, EXTERNAL)

Sensor Profile

System setting

Data Logging

Main Menu

Output Config

interfaces

LCD Setting

Lock Setting

TEDS Data

Diagnostic

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```
  SENSOR PROFILE
  SYSTEM SETTING
▶DATA LOGGING
  OUTPUT CONFIG
```

```
   INTERFACES
   LCD SETTING
▶ LOCK SETTING
   TEDS DATA
```

```
  LOCK SETTINGS
   TEDS DATA
▶ DIAGNOSTIC
  ----------------
```

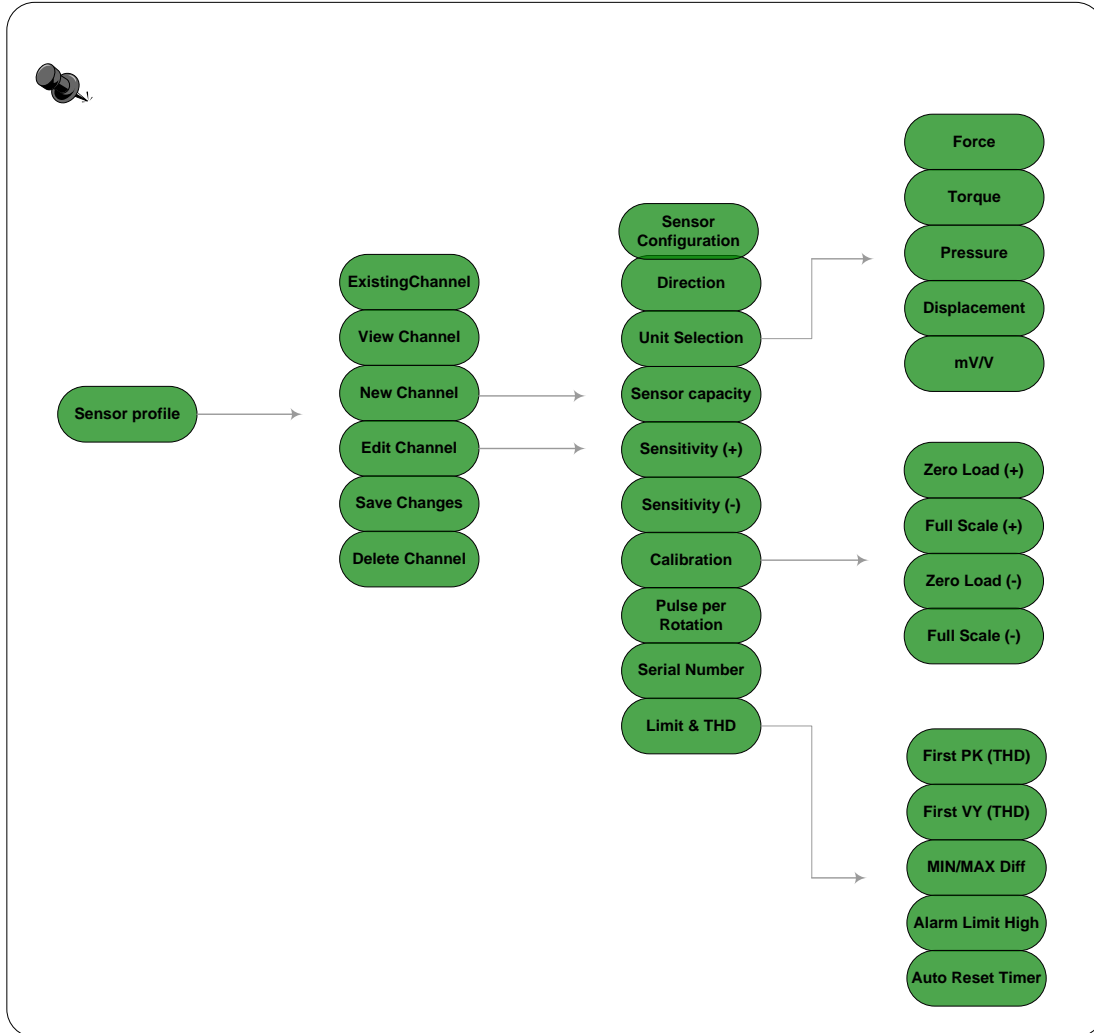**Press the MENU key to enter the main menu.**

Use ▲▼keys to select the desired menu option.

Press ENTER to navigate to the submenu.

The EXIT button can be used at any time to exit any menu or sub menu and return to the display page.

The BACK button can be used at any time to step back from any sub menu.

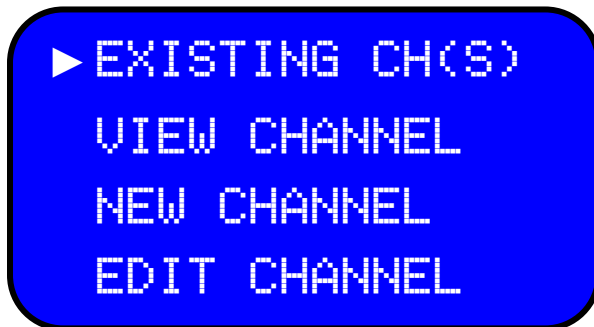## 6.1 Sensor Profile


```
▶ SENSOR PROFILE
  SYSTEM SETTING
  DATA LOGGING
  OUTPUT CONFIG
```

Select "**SENSOR PROFILE**" from the main menu options and press **ENTER**. The following options are available: **EXISTING CH(S)**, **VIEW CHANNEL**, **NEW CHANNEL**, **EDIT CHANNEL**, **SAVE CHANGES**and **DELETE CHANNEL**.

```
▶EXISTING CH(S)
 VIEW CHANNEL
 NEW CHANNEL
 EDIT CHANNEL
```

```
▶EDIT CHANNEL
 SAVE CHANGES
 DELETE CHANNEL
 ---------------
```
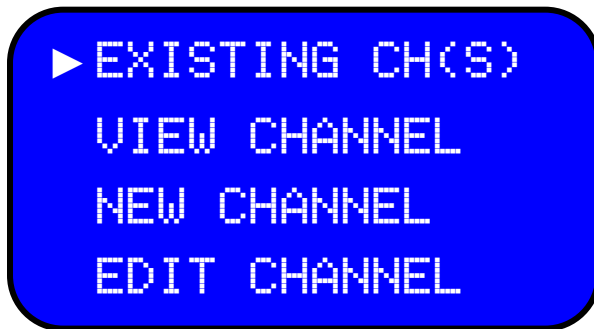
6.1.1   Existing Channels

Scroll to "**EXISTING CH(S)**" using the ▲▼ keys and press **ENTER** to view the different sensor profiles. The IHH500 is able to store up to 15 different sensor profiles.

```
▶EXISTING CH(S)
 VIEW CHANNEL
 NEW CHANNEL
 EDIT CHANNEL
```

```
01√ NA  NA  NA
NA  NA  NA  NA
NA  NA  NA  NA
NA  NA  NA
```

The active channel number will be shown with a check mark on the right.

This function is useful to have a quick view of the number of channels (sensor profile) that have been stored in the internal memory and whether they are active or not. The active channel has a check mark next to it. For example, in this specific figure only channel 01 exists and is active.
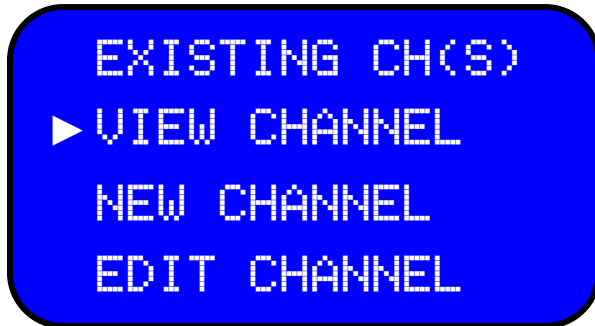
TEDS activity is shown separately. If TEDS is present it will be shown in the bottom right area.

BACK can be pressed at any time to return to other sensor profile options.

```
01√  NA  NA  NA
NA   NA  NA  NA
NA   NA  NA  NA
NA   NA  NA  TD
```
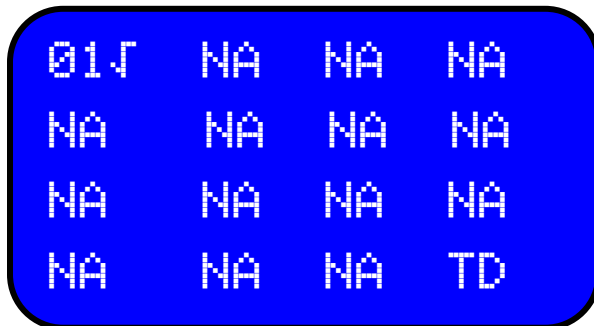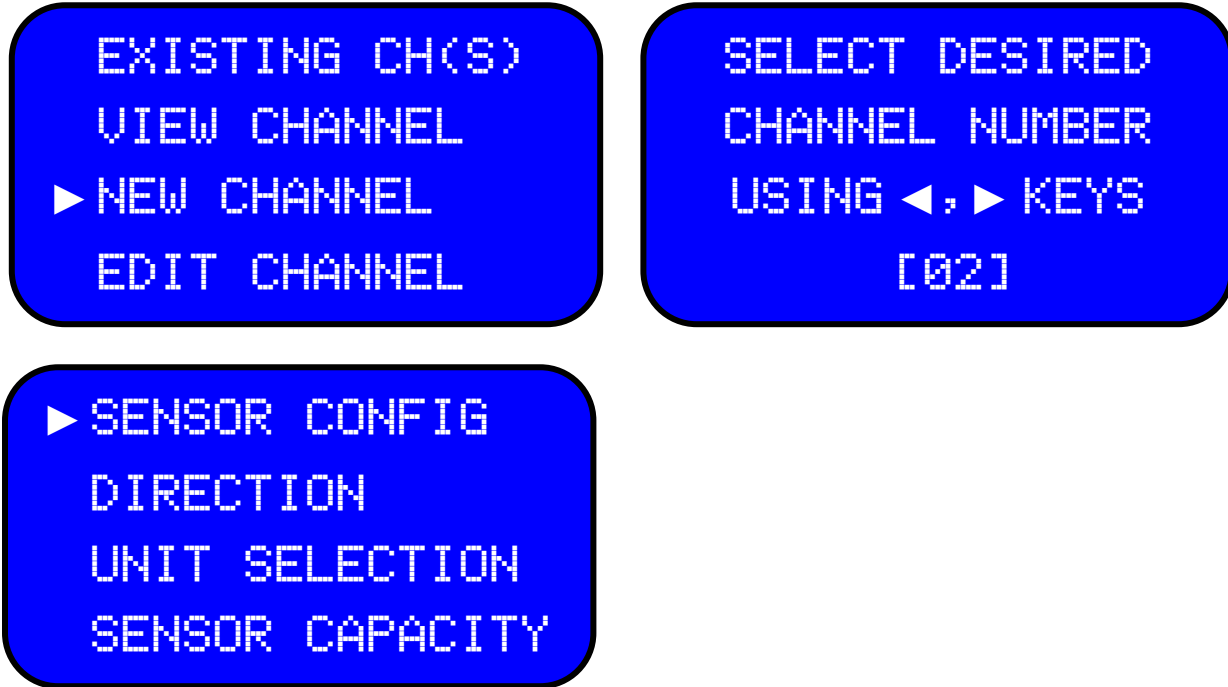
6.1.2 View Channel

Scroll to select "VIEW CHANNEL" form the "SENSOR PROFILE" using the▲▼ keys and press **ENTER** to view: channel number, sensor type, serial number, capacity and engineering unit. If currently more than one channel exists, pressing the arrow ◄► keys on the keypad will cycle through the existing channels.

```
    EXISTING CH(S)
 ▶ VIEW CHANNEL
    NEW CHANNEL
    EDIT CHANNEL
```

```
 CHANNEL        01
 SERIAL          0
 SENSOR     BRIDGE
 +2.00000    mV/V
```

6.1.3 New Channel

Scroll to "NEW CHANNEL" from the "SENSOR PROFILE" using the▲▼ keys and press **ENTER**. Use the ◄► to select the remaining 2 to 15 channels. Press ENTER to set the data for desired channel.

Note: The first channel is already set as default and will be displayed on the screen if no other channel has been set.

```
   EXISTING CH(S)            SELECT DESIRED
   VIEW CHANNEL             CHANNEL NUMBER
 ►NEW CHANNEL               USING ◄,► KEYS
   EDIT CHANNEL                   [02]
```

```
 ►SENSOR CONFIG

   DIRECTION

   UNIT SELECTION

   SENSOR CAPACITY
```

In order to set the new channel data the following steps must be taken exactly in the order in which it is shown on the screen, the ▼key cannot be used to skip the steps. If **EXIT** is pressed while setting the new channel or editing an existing channel, following warning message will be displayed:

```
        WARNING!
      EXIT WITHOUT
    SAVING PROFILE?
    <YES>      <NO>
```
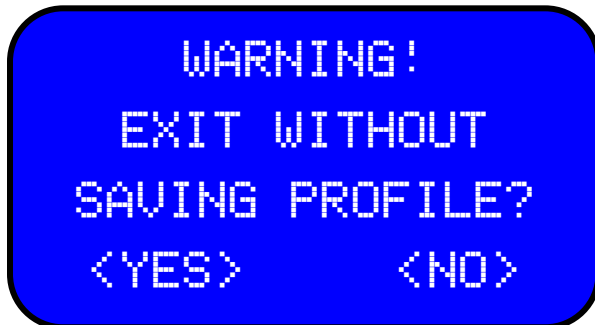
This function is not available if lockout option is enabled. See section 6.7 for further information how to enable or disable lock settings. If this device is being used for the first time, it has not been locked yet. If this device is already locked, the following message will appear if "NEW CHANNEL" is selected:

```
SELECTED FEATURE
IS NOT AVAILABLE
  AT THIS TIME
(HIT ENTER/BACK)
```

6.1.3.1 Sensor Configuration

Scroll to "SENSOR CONFIG" from "NEW CHANNEL" using ▲▼ keys and press the **ENTER** to set a new channel. "SENSOR CONFIG" can also be selected from "EDIT CHANNEL" to make modifications on the existing channels except channel 1. Use the ◀▶ keys to select the sensor type as either "FULL BRIDGE","VOLTAGE OUTPUT", "CURRENT OUTPUT", " BRIDGE& PULSE", "VOLTAGE & PULSE" or "CURRENT & PULSE".

Note: Pulse selection is only available in Elite Version.

Any time a new sensor type is selected, which was not defined before, the device will automatically calibrate itself after it loads the new profile. The following messages will be seen on the screen.

```
▶ SENSOR CONFIG
  DIRECTION
  UNIT SELECTION
  SENSOR CAPACITY
```

```
  SELECT DESIRED
   SENSOR TYPE
  USING ◀,▶ KEYS
  [FULL BRIDGE]
```

```
 LOADING PROFILE
   IN PROGRESS
 PLEASE WAIT  30
```

```
AUTO CALIBRATION
   IN PROGRESS
 PLEASE WAIT  12
 …
```

The following message may be seen if the sensor type is the same as current profile.

```
    OPERATION
  WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```

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6.1.3.2 Direction

Scroll to "DIRECTION" from "NEW CHANNEL" using the ▲ ▼ keys and press **ENTER**. "DIRECTION" can also be selected from "EDIT CHANNEL" to make modifications on the existing channels except channel one.

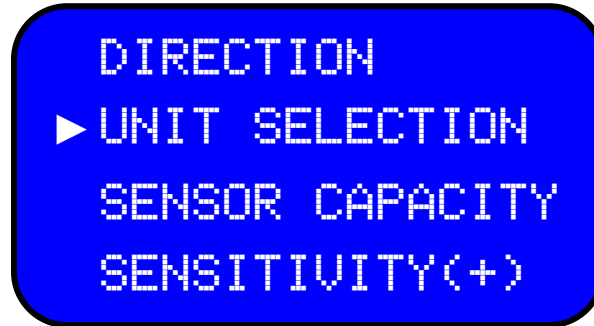Using the ◄ ► keys on the keypad select either uni-direction or bi-direction.

```
► DIRECTION
  UNIT SELECTION
  SENSOR CAPACITY
  SENSITIVITY(+)
```

```
  SELECT DESIRED
  DIRECTION TYPE
  USING ◄,► KEYS
  [UNI-DIRECTION]
```

```
    OPERATION
   WAS EXECUTED
   SUCCESSFULLY
  <HIT ENTER/BACK>
```

6.1.3.3 Unit selection

```
   DIRECTION
 ►UNIT SELECTION
   SENSOR CAPACITY
   SENSITIVITY(+)
```

Scroll to "UNIT SELECTION" from "NEW CHANNEL" using the ▲ ▼ keys and press **ENTER**. It can also be selected from "EDIT CHANNEL" to make modifications on the existing channel except channel one. Using the ▲ ▼ keys select one of the following four groups of Engineering Units: FORCE, TORQUE, PRESSURE, and DISPLACEMENT and standard mV/V for the new channel.

```
   FORCE (MASS)
 ►TORQUE
   PRESSURE
   DISPLACEMENT
```

```
 ►PRESSURE
   DISPLACEMENT
   mV/V
   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
```
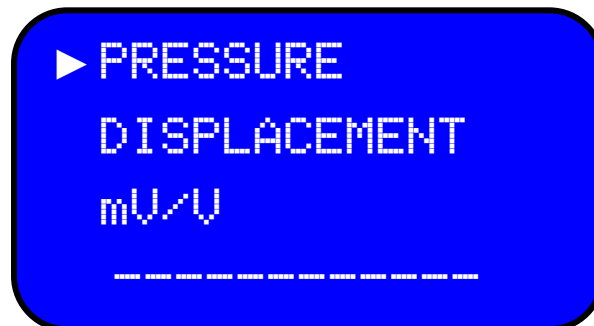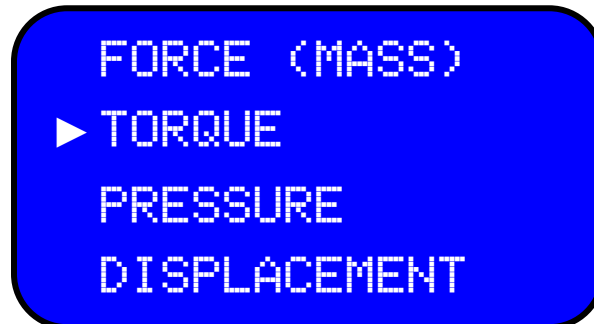
6.1.3.3.1   Force (MASS)

Scroll to "**FORCE (MASS)**" from "**UNIT SELECTION**" using the▲▼ keys and press **ENTER**. The following options can be selected for force: **µg**, **mg**, **g**, **kg**, **M- tone**, **dyn**, **kdyn**, **Mdyn**, **N**, **kN**, **oz**, **lbs**, **klb**, **ton (US)** and **ton (UK)**. Once the desired force unit is selected, the following message will appear.

```
►FORCE (MASS)
 TORQUE
 PRESSURE
 DISPLACEMENT
```

```
 SELECT DESIRED
ENGINEERING UNIT
 USING ◄,► KEYS
    [µɘ]
```

```
 OPERATION
 WAS EXECUTED
 SUCCESSFULLY
(HIT ENTER/BACK)
```

6.1.3.3.2   Torque

Scroll to "TORQUE" from "UNIT SELECTION" using the ▲ ▼ keys and press **ENTER**. The following options for torque can be selected: **g-mm**, **g-cm**, **g-m**, **kg-cm**, **kg-m**, **N-mm**, **N-cm**, **N-m**, **kN-m**, **in-oz**, **in-lb**, and **ft-lb.** Once the desired torque unit is selected, the following message will be shown.
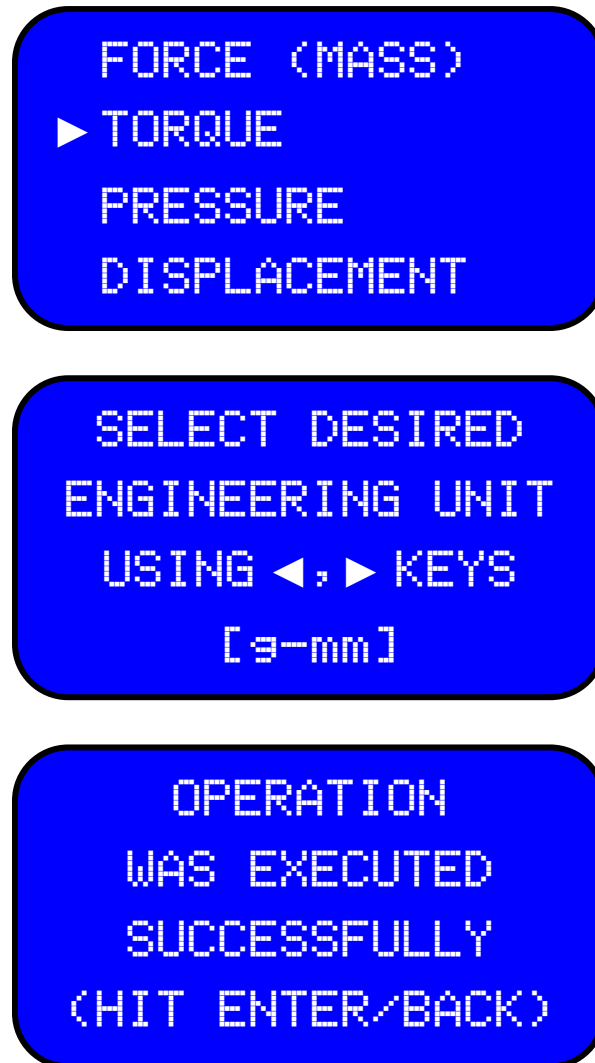
```
     FORCE (MASS)
  ► TORQUE
     PRESSURE
     DISPLACEMENT
```

```
   SELECT DESIRED
 ENGINEERING UNIT
   USING ◄,► KEYS

      [g-mm]
```

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```

Note: When a torque sensor is configured, the HOLD and SHUNT keys are disabled on the main page showing the speed, angle and torque. Using the HOLD and SHUNT keys will prompt a warning message.

6.1.3.3.3   Pressure

Scroll to "**PRESSURE**" from "**UNIT SELECTION**" using the ▲▼ keys and press **ENTER**. The following options can be selected for pressure: **Pa**, **kPa**, **mbar**, **bar**, **MPa**, **kg/cm²**, **atm** (standard atmosphere), **mm-HG**, **in-H2O**, **ft-H2O**, **psi**, and **kpsi**. Once the desired pressure unit is selected, the following message will be shown.

```
      FORCE (MASS)

      TORQUE

   ►  PRESSURE

      DISPLACEMENT
```

```
      SELECT DESIRED

   ENGINEERING UNIT

     USING ◄,► KEYS

          [Pa]
```

```
        OPERATION

      WAS EXECUTED

      SUCCESSFULLY

   (HIT ENTER/BACK)
```
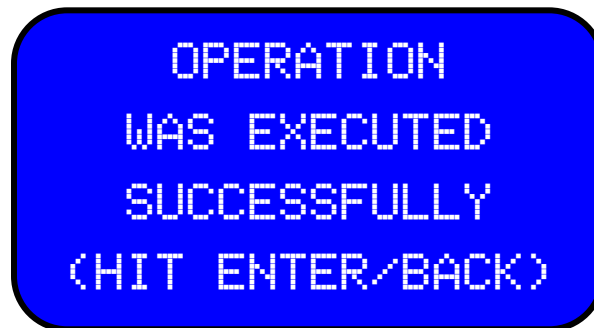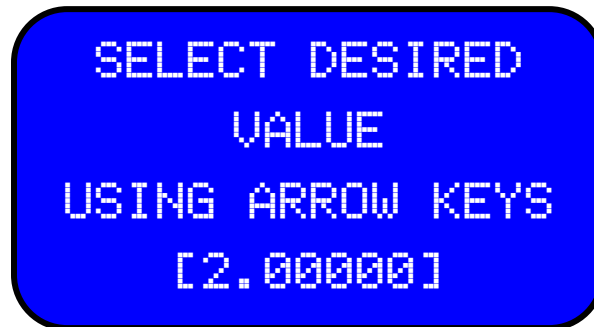
6.1.3.3.4   Displacement

Scroll to "**DISPLACEMENT**" from "**UNIT SELECTION**" using the▲▼ keys and press **ENTER**. The following units can be selected for displacement: **mm**, **cm**, **dm**, **m**, **km**, **in**, **ft**, **yds**, and **mile**. Once the desired displacement unit is selected, the following message will be shown.

```
    PRESSURE
 ►DISPLACEMENT
   mV/V
   _____
```

```
  SELECT DESIRED
ENGINEERING UNIT
  USING ◄,► KEYS
       [mm]
```

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 (HIT ENTER/BACK)
```
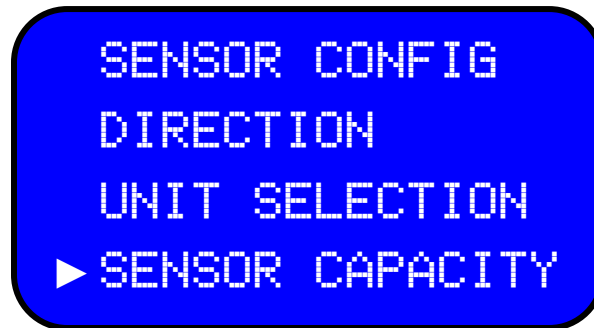
6.1.3.3.5   mV/V

Scroll to "**mV/V**" from "**UNIT SELECTION**" using the ▲▼ keys and press **ENTER.** Once the desired displacement unit is selected, the following message will be shown.

```
    PRESSURE
    DISPLACEMENT
 ▶ mV/V
    _____
```

```
       OPERATION
     WAS EXECUTED
     SUCCESSFULLY
   (HIT ENTER/BACK)
```
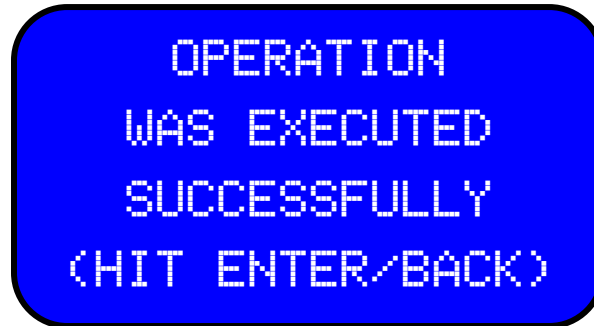
6.1.3.4 Sensor Capacity

Scroll to "**SENSOR CAPACITY**" from "**NEW CHANNEL**" using the ▲▼ keys and press **ENTER**. "**SENSOR CAPACITY**" can also be selected from "**EDIT CHANNEL**" to make modifications on the existing channels except channel one.

Using the ◄ ► keys move the cursor to the desired placement and use the ▲▼ keys to select the desired number or decimal position. The capacity can be selected from 0.00001 to 9999999.

```
   SENSOR CONFIG
   DIRECTION
   UNIT SELECTION
 ► SENSOR CAPACITY
```

```
   SELECT DESIRED
       VALUE
   USING ARROW KEYS
      [2.00000]
```

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
  <HIT ENTER/BACK>
```

6.1.3.5 Sensitivity (+)

```
  SENSOR CONFIG
►SENSITIVITY(+)
  UNIT SELECTION
  SENSOR CAPACITY
```

```
   SELECT SENSOR
   mV/V OUTPUT
  USING ARROW KEYS
    [2.00000]
```

Scroll to "**SENSITIVITY (+)**" from "**NEW CHANNEL**" using the ▲ ▼ keys and press **ENTER** to set the sensitivity for a new channel. "**SENSITIVITY**" can also be selected from "**EDIT CHANNEL**" to make modifications on the existing channel except channel one. Sensitivity of the channel can be selected in mV/V using the ◄ ► and the ▲ ▼ keys.

If the actual sensitivity is not known, but the specific range is known, use the larger number. For example if the sensitivity of the sensor is between 2 mV/V and 3 mV/V, 3mV/V should be entered. A live calibration would then be needed to find the actual mV/V. Any time a new sensor sensitivity is set, the device may do an auto calibration after it loads the new profile.

The following messages will be seen on the screen.

Note: Sensitivity can be defined for *bridge sensors and voltage sensors.* **This option is disabled for current sensors.**

```
LOADING PROFILE
  IN PROGRESS
PLEASE WAIT 30
```

```
AUTO CALIBRATION
  IN PROGRESS
PLEASE WAIT  15
.........
```

The following message will be seen if the sensor sensitivity is the same as current profile.
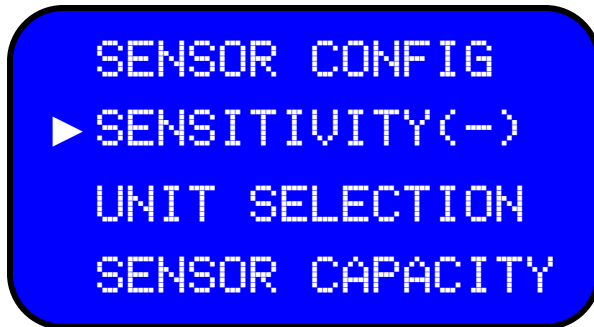
```
   OPERATION
  WAS EXECUTED
  SUCCESSFULLY
(HIT ENTER/BACK)
```

Note: For voltage sensor device asks for voltage output.
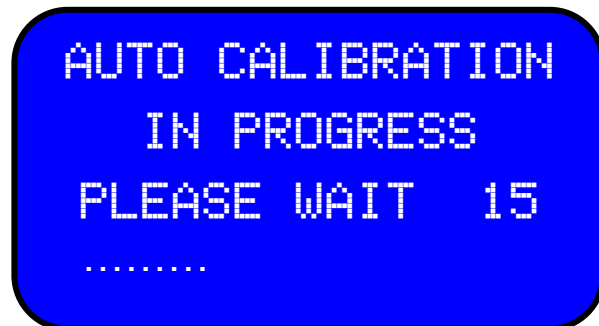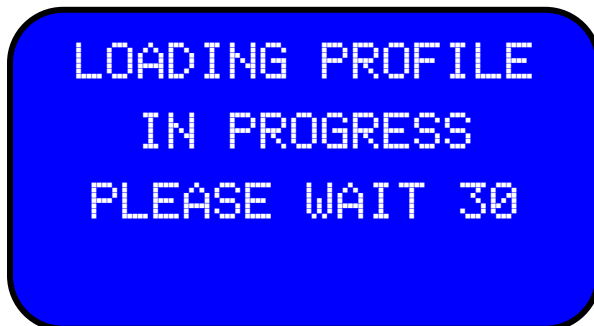
6.1.3.6 Sensitivity (-)

```
  SENSOR CONFIG
▶ SENSITIVITY(-)
  UNIT SELECTION
  SENSOR CAPACITY
```

```
  SELECT SENSOR
   mV/V OUTPUT
 USING ARROW KEYS
    [2.00000]
```

Scroll to "SENSITIVITY (-)" from "NEW CHANNEL" using the ▲▼ keys and press **ENTER** to set the sensitivity for a new channel. "SENSITIVITY" can also be selected from "EDIT CHANNEL" if to make modifications on the existing channels except channel one. Sensitivity of the channel can be selected in mV/V using the ◀▶ and the ▲▼ keys.

If the actual sensitivity is not known, but the specific range is known, use the larger number. For example if the sensitivity of the sensor is between 2 mV/V and 3 mV/V, 3mV/V should be entered. A live calibration would then be needed to find the actual mV/V. Any time that a new sensor sensitivity is set, the device may do an auto calibration after it loads the new profile.

Note that sensitivity can be defined for *bridge sensors and voltage sensors.* **This option is disabled for current and pulse sensors.**

Note: If a Uni-directional sensor is configured in "DIRECTION" the section is not available, otherwise if the sensor is Bi-directional configured and the following step shall be taken for the negative values:

```
 LOADING PROFILE
   IN PROGRESS
 PLEASE WAIT 30
```

```
AUTO CALIBRATION
   IN PROGRESS
 PLEASE WAIT  15
.........
```

The following message will be seen if the sensor sensitivity is the same as current profile.

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
(HIT ENTER/BACK)
```
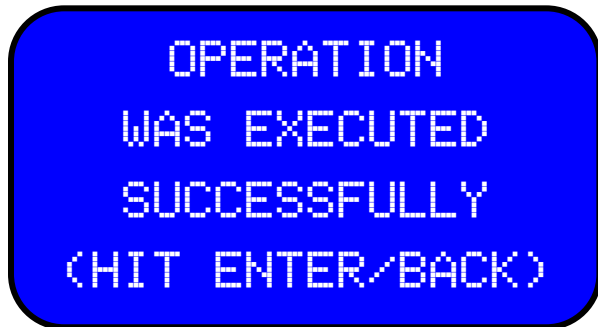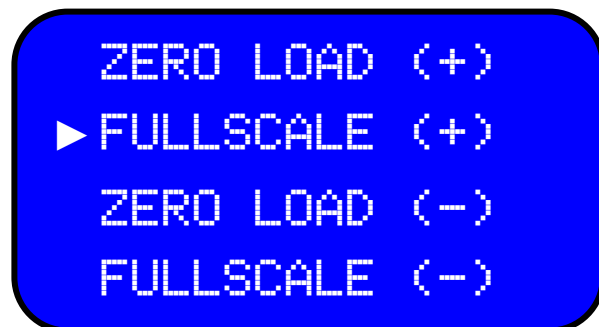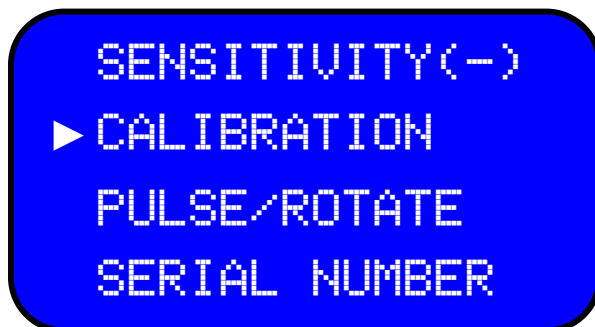
6.1.3.7 Calibration

Scroll to "CALIBRATION" from "NEW CHANNEL" using ▲▼ keys and press **ENTER** to set it for the new channel. "CALIBRATION" can also be selected from "EDIT CHANNEL" to make modifications on the existing channels except channel one.

Note: This function is dedicated for precise calibration (live calibration), however if the user would not like to apply the load, in the sensitivity selection (6.1.3.5 & 6.1.3.6) manipulating method **must** be done accurately otherwise the calculation is not correct.
For example: Using a calibration certification with the sensitivity, the number must be entered in the sensitivity selection (6.1.3.5& 6.1.3.6) and this step can be skipped. However it is recommended to use this step and manually live calibrate the sensor.
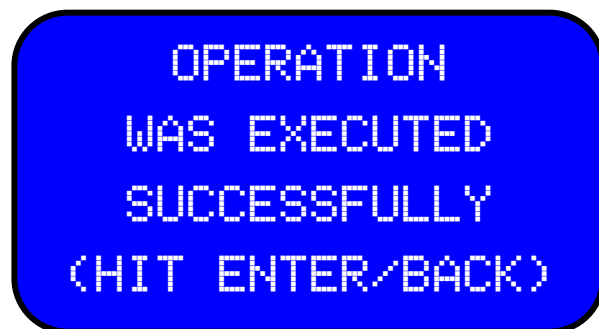If user does not have actual sensitivity and has already entered an estimated value in Sensitivity Section (6.1.3.5 & 6.1.3.6) this step must be executed carefully.

After performing all calibration steps and entering zero load and full scale, device is able to calculate the actual SENSITIVITY value and update it. SENSOR CONFIGURATION menu will now contain the actual value.

```
   SENSITIVITY(-)
 ►CALIBRATION
   PULSE/ROTATE
   SERIAL NUMBER
```

```
   ZERO LOAD (+)
 ►FULLSCALE (+)
   ZERO LOAD (-)
   FULLSCALE (-)
```

6.1.3.7.1   Zero Load (+)

Scroll to "ZERO LOAD (+)" from "CALIBRATION" using the ▲▼ keys and press **ENTER**.

```
      APPLY
   ZERO LOAD(+)
    CALIBRATION
 THEN PRESS ENTER
```

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```

6.1.3.7.2   Full Scale (+)

Scroll to "**FULL SCALE (+)**" from "**CALIBRATION**" using the ▲ ▼ keys and press **ENTER**.

```
        APPLY

    FULL SCALE(+)

     CALIBRATION

  THEN PRESS ENTER
```

```
      OPERATION

    WAS EXECUTED

    SUCCESSFULLY

  (HIT ENTER/BACK)
```

If the channel "**DIRECTION**" is defined as "**BI-DIRECTION**" it will be prompt to apply the full scale calibration (-) as well as zero load (-) for the reverse direction.

6.1.3.7.3   Zero Load (-)

Scroll to "**ZERO LOAD (-)**" from "**CALIBRATION**" using the▲ ▼ keys and press **ENTER**.

```
        APPLY

    ZERO LOAD(-)

     CALIBRATION

  THEN PRESS ENTER
```

```
      OPERATION

    WAS EXECUTED

    SUCCESSFULLY

  (HIT ENTER/BACK)
```

6.1.3.7.4   Full Scale (-)

Scroll to "**FULL SCALE (-)**" from "**CALIBRATION**" using the▲ ▼ keys and press **ENTER**.

```
        APPLY

    FULL SCALE(-)

     CALIBRATION

  THEN PRESS ENTER
```

```
      OPERATION

    WAS EXECUTED

    SUCCESSFULLY

  (HIT ENTER/BACK)
```
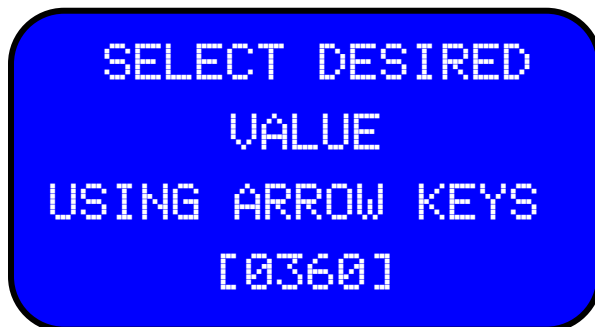
6.1.3.8 Pulse per rotation

Scroll to "**PULSE/ROTATE**" from "**NEW CHANNEL**" using the▲▼ keys and press **ENTER**. "**PULSE/ROTATE**" can also be selected from "**EDIT CHANNEL**" to make modifications on the existing channels except channel one.

Note: This option is only available for rotary sensors with encoders as defined in sensor configuration sub-menu (6.1.3.1).

```
    DIRECTION
    CALIBRATION
  ▶PULSE/ROTATE
    SERIAL NUMBER
```
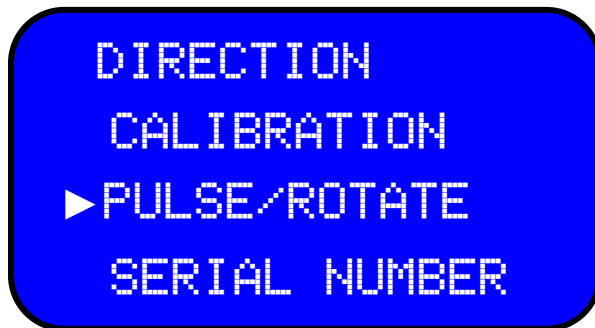
Using the◀▶ keys move the cursor to the desired placemen, and use the ▲▼ keys the desired number. Number of pulse per rotations (PPR) can be defined for either rotary or speed sensors. Up to 9999 pulse per rotation can be defined.
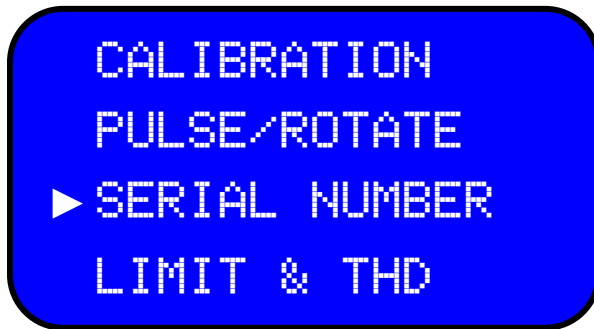
```
  SELECT DESIRED
      VALUE
  USING ARROW KEYS
      [0360]
```

A confirmation message will be displayed confirming that desired operation was successfully executed.

```
    OPERATION
   WAS EXECUTED
   SUCCESSFULLY
  (HIT ENTER/BACK)
```
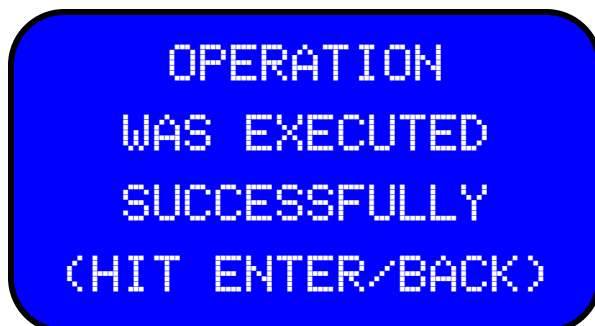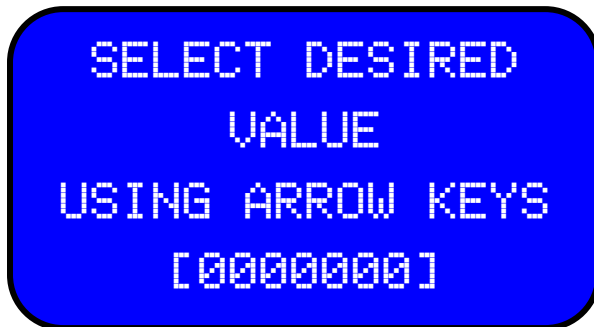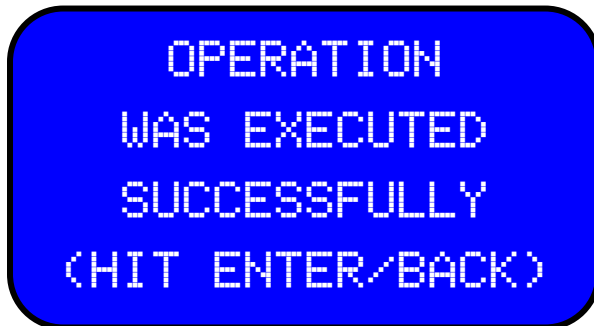
6.1.3.9 Serial number

Scroll to "SERIAL NUMBER" from "NEW CHANNEL" using the ▲▼ keys and press ENTER. "SERIAL NUMBER" can also be selected from "EDIT CHANNEL" to make modifications on the existing channels except channel one.

```
    CALIBRATION
    PULSE/ROTATE
  ► SERIAL NUMBER
    LIMIT & THD
```

Using the ◄► keys, the cursor can be moved among the seven digits and use the ▲▼ keys to select the desired serial number.
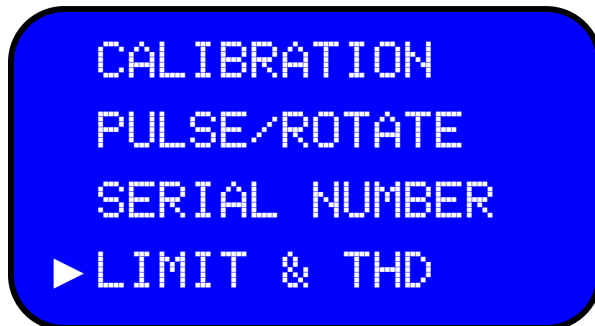
```
   SELECT DESIRED
       VALUE
  USING ARROW KEYS
      [0000000]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
  (HIT ENTER/BACK)
```

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6.1.3.10   Limit & THD

Scroll to **LIMIT & THD**" from **"NEW CHANNEL**" using the▲▼ keys and press **ENTER**." **LIMIT & THD**" can also be selected from "**EDIT CHANNEL**" to make modifications on the existing channels except channel one.

```
  CALIBRATION
  PULSE/ROTATE
  SERIAL NUMBER
►LIMIT & THD
```

6.1.3.10.1   First Peak THD

Scroll to "**FIRST PK THD**" from "**LIMIT & THD**" using the▲▼ keys and press **ENTER**.
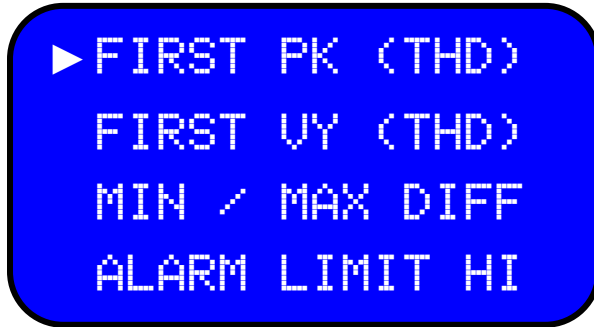
```
▶FIRST PK (THD)
 FIRST VY (THD)
 MIN / MAX DIFF
 ALARM LIMIT HI
```

Use the arrow keys to move the cursor among the digits and select the desired number for the First Peak. The sign value can also be changed from positive to negative in case a bi-directional sensor is configured.

```
  SELECT DESIRED
      VALUE
 USING ARROW KEYS
    [+050.00%]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
    OPERATION
   WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```
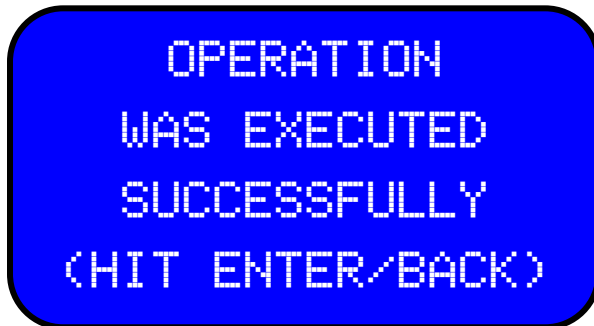
(See Figures no.1 and 2 on page 50 for examples of threshold levels on one directional and two directional sensors).

6.1.3.10.2   First Valley THD

Scroll to "FIRST VY (THD)" from "LIMIT & THD" using the ▲ ▼ keys and press ENTER.
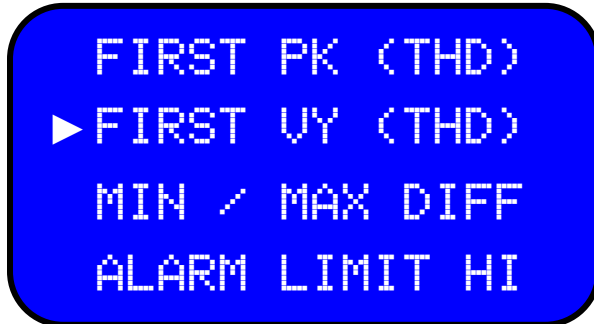
```
   FIRST PK (THD)
 ▶FIRST VY (THD)
   MIN / MAX DIFF
   ALARM LIMIT HI
```

Use the arrow keys to move the cursor among the digits and select the desired number for the First Valley. The sign value can also be changed from positive to negative in case a bi-directional sensor is configured.

```
   SELECT DESIRED
       VALUE
  USING ARROW KEYS
     [+030.00%]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
  (HIT ENTER/BACK)
```

(See Figures no.1 and 2 on page 50 for examples of threshold levels on one directional and two directional sensors).

FP

Unit

80%

FP THD

THD

FV THD

10%

FV

t
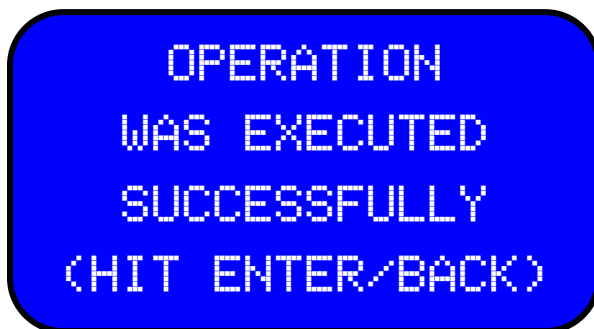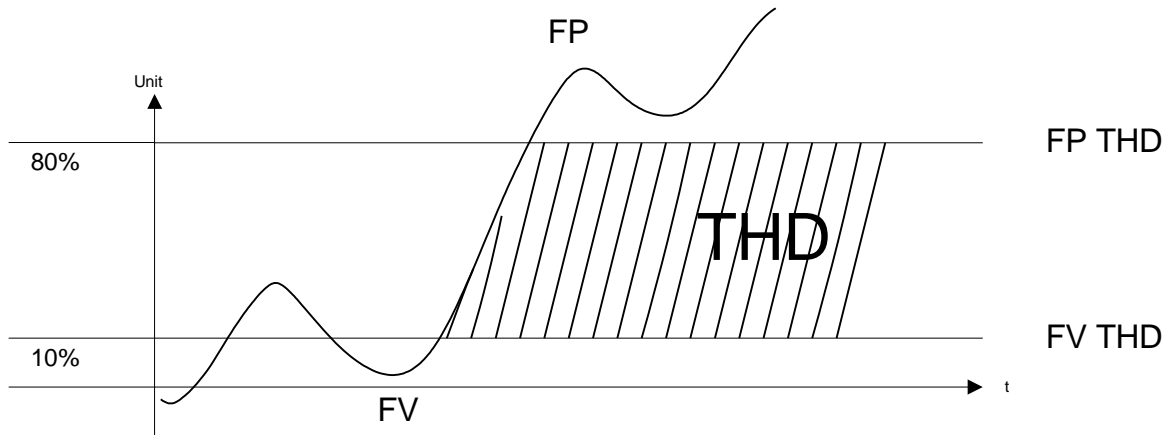
Figure No.1
Example of One Directional Sensor

FP

Unit

50%

FP THD

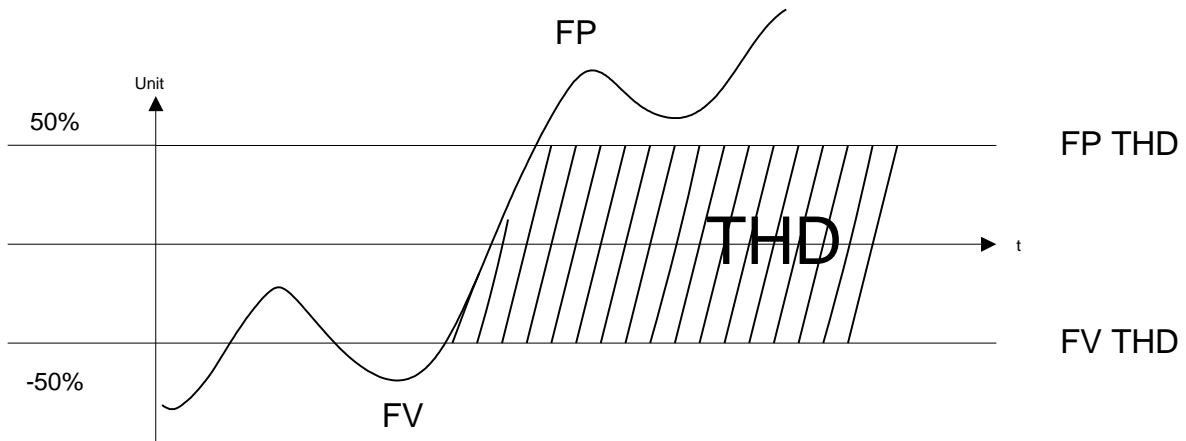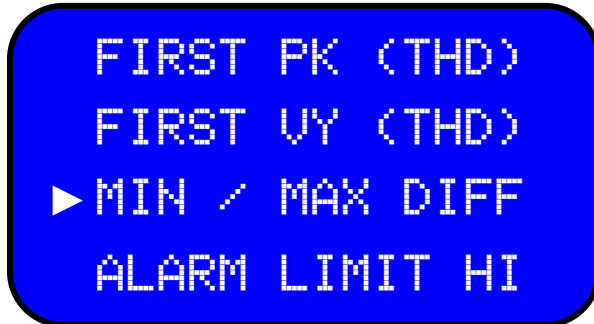THD

t

FV THD

-50%

FV

Figure No.2
Example of Two Directional Sensor

6.1.3.10.3   MIN/MAX Differentiation

Scroll to "MIN / MAX DIFF" from "LIMIT & THD" using the ▲ ▼ keys and press ENTER.

```
   FIRST PK (THD)
   FIRST VY (THD)
 ►MIN / MAX DIFF
   ALARM LIMIT HI
```

Use the arrow keys to move the cursor among the digits and select the desired number for the Min/Max Differentiations. The sign value can also be changed from positive to negative in case a bi-directional sensor is configured.

```
   SELECT DESIRED
       VALUE
 USING ARROW KEYS
    [+010.00%]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
     OPERATION
    WAS EXECUTED
    SUCCESSFULLY
  (HIT ENTER/BACK)
```
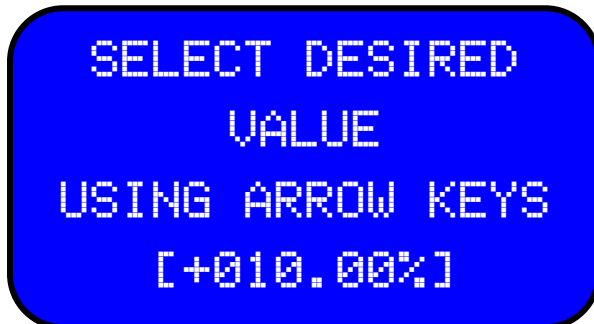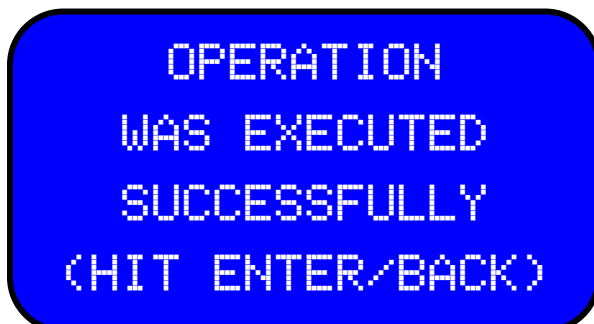
(See Figure no.3 on page 52 for examples of Min/Max Differentiation).
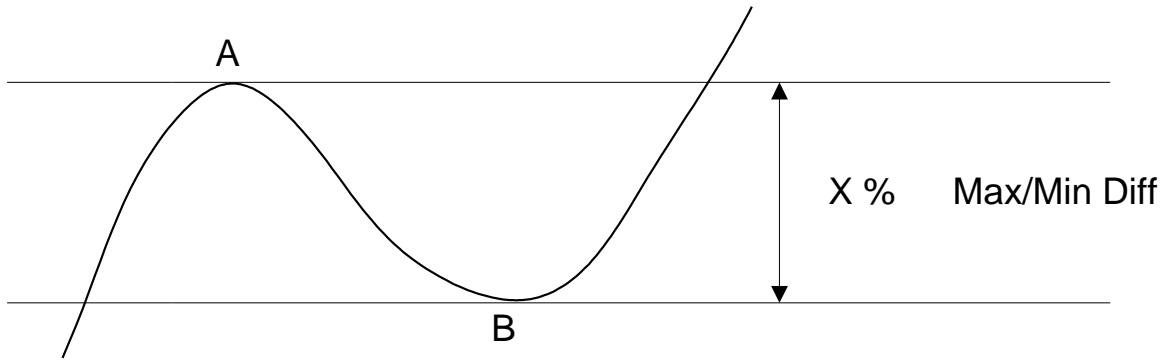
A

B

X %   Max/Min Diff

Figure No.3
Max/ Min Differentiation

Caution should be taken in defining X, for the Max/Min Diff.
For example:

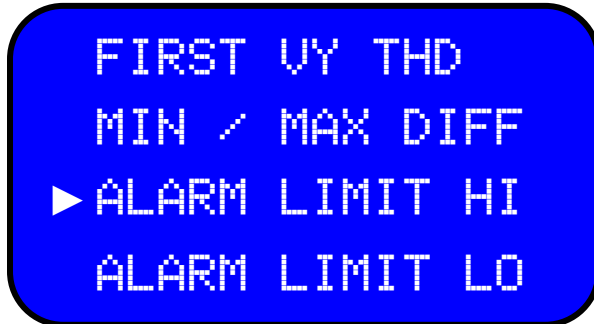Consider the following data at points A and B:
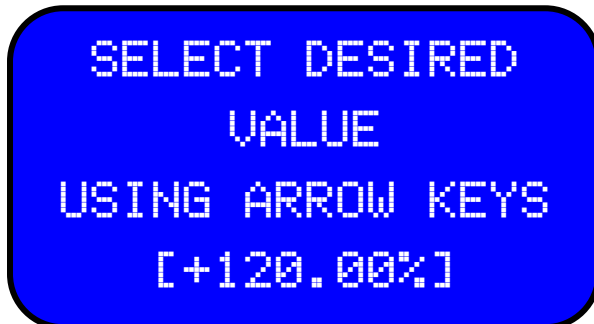A: 100 IL
B: 90IL

If X is considered less than 10%, A would not be considered as first peak, or B would not be considered as first valley.

6.1.3.10.4   Alarm Limit High

Scroll to "**ALARM LIMIT HI**" from "**LIMIT(S) & THD(S)**" using the ▲ ▼ keys and press **ENTER**.

```
   FIRST VY THD
   MIN / MAX DIFF
 ►ALARM LIMIT HI
   ALARM LIMIT LO
```

Use the arrow keys to move the cursor among the digits and select the desired number for the Alarm Limit High. The sign value can also be changed from positive to negative in case a bi-directional sensor is configured.

```
  SELECT DESIRED
      VALUE
 USING ARROW KEYS
    [+120.00%]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```
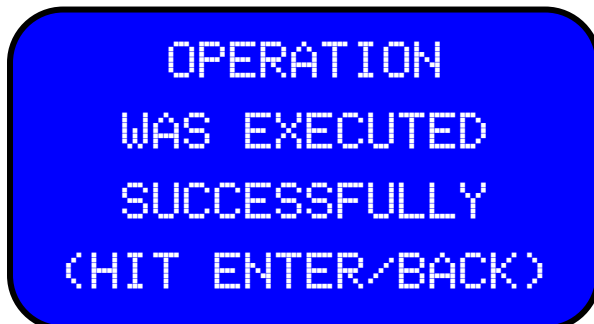
(See Figures no. 4 and 5 on page 55 for examples of alarm threshold levels for one directional and two directional sensors).

6.1.3.10.5   Alarm Limit Low

Scroll to "ALARM LIMIT LO" from "LIMIT & THD" using the ▲ ▼ keys and press ENTER.

```
   MIN/MAX DIFF
   ALARM LIMIT HI
 ►ALARM LIMIT LO
   AUTO RST (SEC)
```

Use the arrow keys to move the cursor among the digits and select the desired number for the Alarm Limit Low. The sign value can also be changed from positive to negative in case a bi-directional sensor is configured.
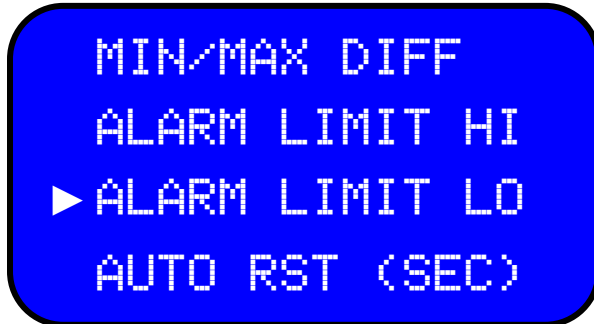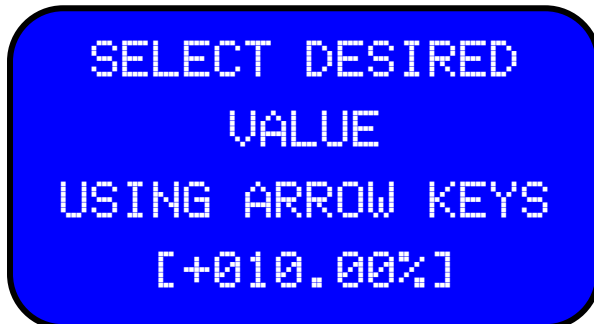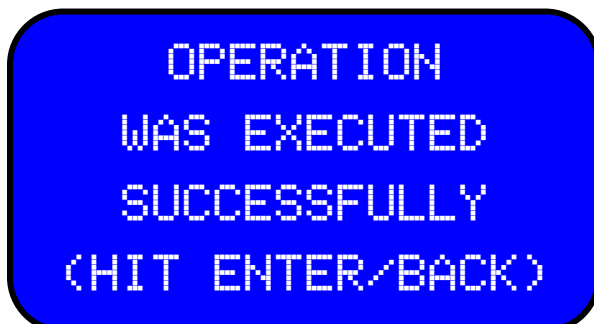
```
  SELECT DESIRED
      VALUE
 USING ARROW KEYS
    [+010.00%]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
     OPERATION
   WAS EXECUTED
   SUCCESSFULLY
 (HIT ENTER/BACK)
```

(See Figure no.4 and 5 on page 55 for examples of alarm threshold levels for one directional and two directional sensors).

Alarm Area

Unit

80%

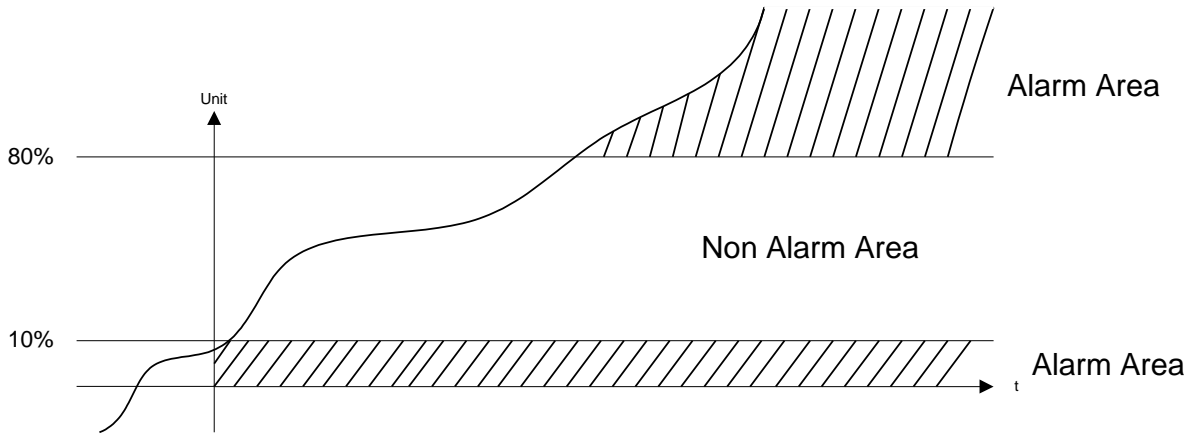Non Alarm Area

10%

Alarm Area

t

Figure No.4
Example of One Directional Sensor

Alarm Area
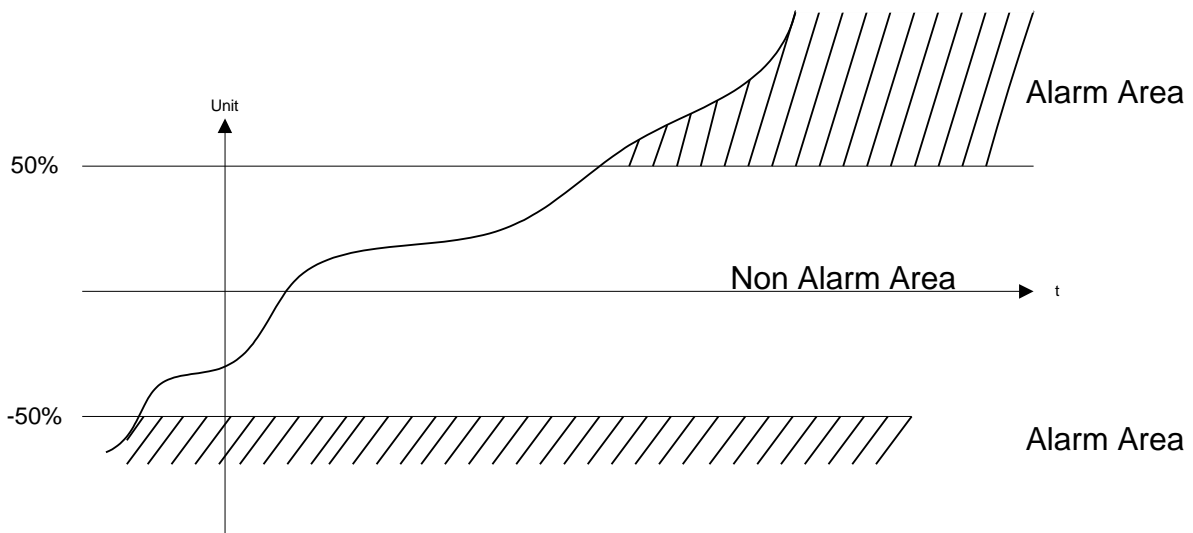
Unit

50%

Non Alarm Area

t

-50%

Alarm Area

Figure No.5
Example of Two Directional Sensor

6.1.3.10.6   Auto Reset Timer

Scroll to "**AUTO RST (SEC)**" from "**LIMIT & THD**" using the▲ ▼ keys and press **ENTER**.

```
 ALARM LIMIT HI
 ALARM LIMIT LO
▶AUTO RST (SEC)
 _____
```

Use the arrow keys to move the cursor among the digits and select the desired number.

```
 SELECT DESIRED
     VALUE
 USING ARROW KEYS
     [0010]
```

A confirmation message will be displayed confirming operation was successfully executed.

```
   OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 ⟨HIT ENTER/BACK⟩
```
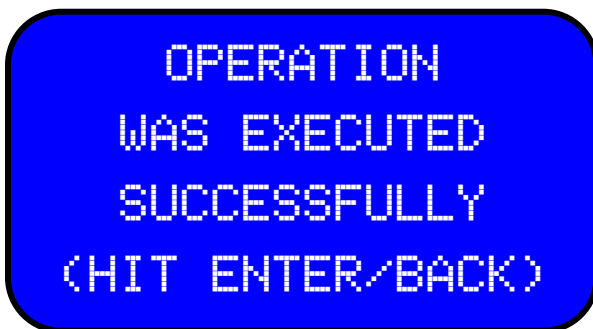
6.1.4   Edit Channel

Scroll to "**EDIT CHANNEL**" from "**SENSOR PROFILE**" using the ▲ ▼ keys and press **ENTER**.

```
   VIEW CHANNEL
   NEW CHANNEL
 ▶EDIT CHANNEL
   SAVE CHANGES
```
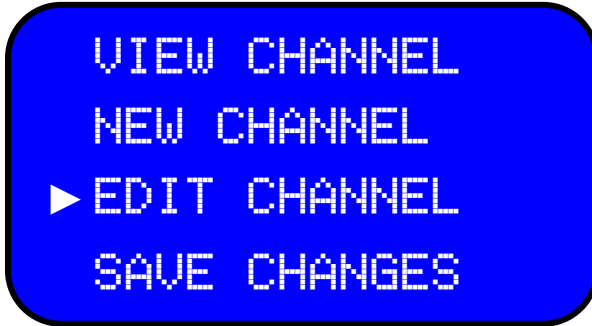
Attempting to edits channels when no channel has been set beside channel one, which was set by default, will result the following warning:

```
   THERE IS NOT
   ANY CHANNEL
  AVAILABLE FOR
  THIS INTENTION!
```
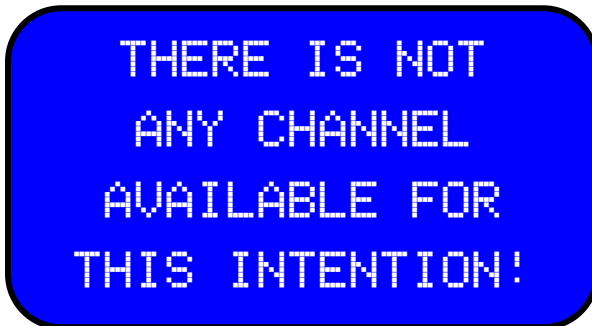
To edit channel option is not available if the lockout option is enabled.
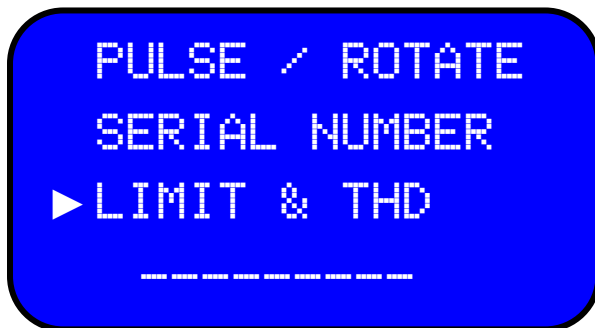See section 6.7 for further information on lock settings how to enable or disable lock.

If this device is already locked the following message will be displayed "**EDIT CHANNEL**":

```
 SELECTED FEATURE
 IS NOT AVAILABLE
   AT THIS TIME
 (HIT ENTER/BACK)
```

Use the ◄ ► to select the channel to edit.

```
  SELECT DESIRED
 CHANNEL NUMBER
 USING  ◄,►  KEYS
       [02]
```

All the features that are accessible in the "New CHANNEL" option, applies to the Edit Channel option as well.

```
►SENSOR CONFIG
  SENSITIVITY
  UNIT SELECTION
  SENSOR CAPACITY
```

```
  PULSE / ROTATE
  SERIAL NUMBER
►LIMIT & THD
  ____ ____ ____ ____ ____ ____ ____ ____ ____
```
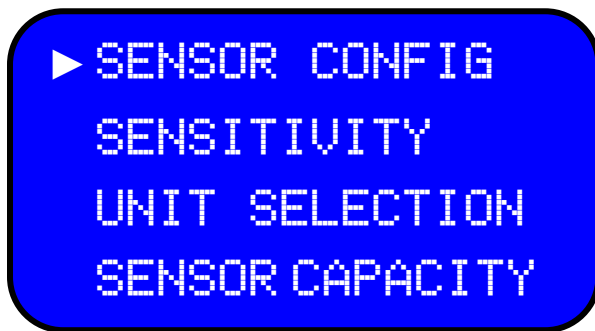
6.1.4.1 Sensor Configuration

See the details mentioned in section 6.1.3.1.

6.1.4.2 Direction

See the details mentioned in section 6.1.3.2.

6.1.4.3 Unit selection

See the details mentioned in section 6.1.3.3.

6.1.4.3.1   Force (MASS)

See the details mentioned in section 6.1.3.3.1.

6.1.4.3.2   Torque

See the details mentioned in section 6.1.3.3.2.

6.1.4.3.3   Pressure

See the details mentioned in section 6.1.3.3.3.

6.1.4.3.4   Displacement

See the details mentioned in section 6.1.3.3.4.

6.1.4.3.5   mV/V

See the details mentioned in section 6.1.3.3.5.

6.1.4.4 Sensor Capacity

See the details mentioned in section 6.1.3.4.

6.1.4.5 Sensitivity (+)

See the details mentioned in section 6.1.3.5.

6.1.4.6 Sensitivity (-)

See the details mentioned in section 6.1.3.6.

6.1.4.7 Calibration

See the details mentioned in section 6.1.3.7.

6.1.4.7.1   Zero Load (+)

See the details mentioned in section 6.1.3.7.1

6.1.4.7.2   Full Scale (+)

See the details mentioned in section 6.1.3.7.2

6.1.4.7.3   Zero Load (-)

See the details mentioned in section 6.1.3.7.3

6.1.4.7.4   Full Scale (-)

See the details mentioned in section 6.1.3.7.4

6.1.4.8 Pulse per rotation

See the details mentioned in section 6.1.3.8.

6.1.4.9 Serial number

See the details mentioned in section 6.1.3.9.

6.1.4.10   Limit & THD

See the details mentioned in section 6.1.3.10.

6.1.4.10.1   First Peak (THD)

See the details mentioned in section 6.1.3.10.1.

6.1.4.10.2   First Valley (THD)

See the details mentioned in section 6.1.3.10.2.

6.1.4.10.3   MIN/MAX Differentiation

See the details mentioned in section 6.1.3.19.3.

6.1.4.10.4   Alarm Limit High

See the details mentioned in section 6.1.3.10.4.

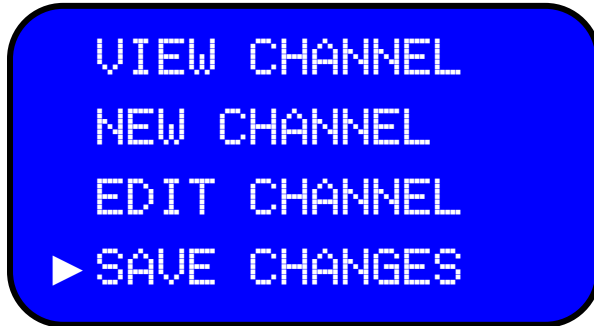6.1.4.10.5   Alarm Limit Low

See the details mentioned in section 6.1.3.10.5.

6.1.4.10.6   Auto Reset Timer

See the details mentioned in section 6.1.3.10.6.

6.1.5 Save Changes

Scroll to "SAVE CHANGES" from "SENSOR PROFILE" using the ▲▼ keys and press **ENTER** to save the modifications that are made under the Edit Channel or New Channel menu.

```
   VIEW CHANNEL
   NEW CHANNEL
   EDIT CHANNEL
 ▶ SAVE CHANGES
```
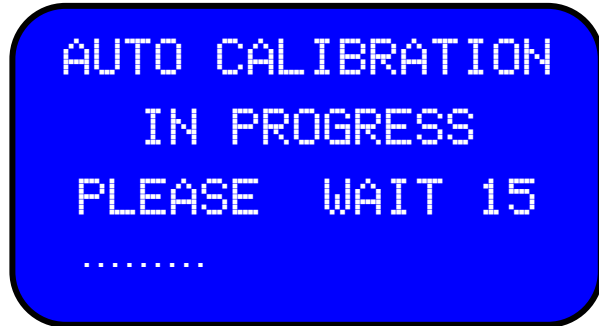
The Save Changes option is not available if the lockout option is enabled. See section 6.7 for further information on lock settings. If this device is already locked the following message will be displayed.
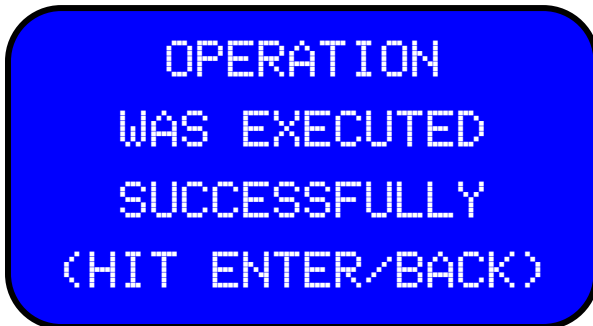
```
 SELECTED FEATURE
 IS NOT AVAILABLE
    AT THIS TIME
 (HIT ENTER/BACK)
```

Once a new channel or modifications to the existing channel are saved, the new profile will be loaded. The previous profile cannot be re loaded.

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Anytime that a new sensor sensitivity is set or the sampling rate is changed, the device may do an auto calibration after it loads the new profile.

```
 LOADING PROFILE
   IN PROGRESS
 PLEASE WAIT  30
```

```
 AUTO CALIBRATION
    IN PROGRESS
 PLEASE  WAIT 15
 .........
```
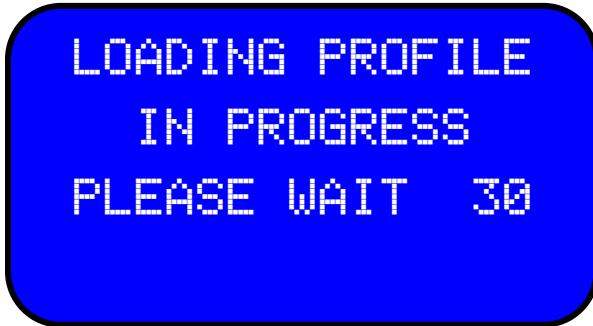
The following confirmation message will be displayed:

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 (HIT ENTER/BACK)
```

If the sensitivity of the new channel configuration or the modification is unchanged, a message confirming that the desired operation was successfully executed will be given.

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 (HIT ENTER/BACK)
```
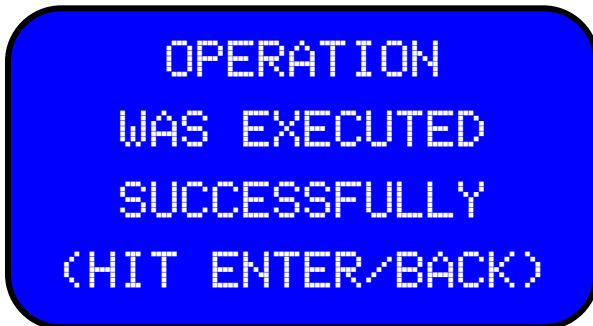
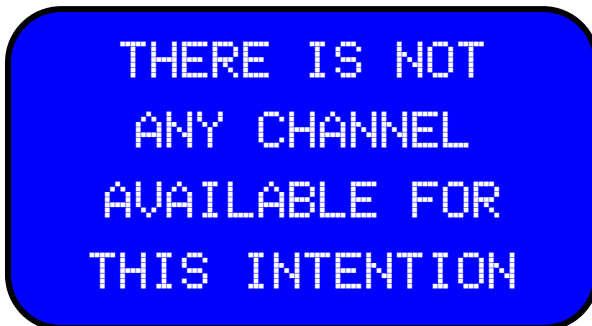### 6.1.6   Delete Channel

Scroll to "DELETE CHANNEL" from "SENSOR PROFILE" using the▲▼ keys and press ENTER. Use the ◄► keys to select the channel to delete. Choose Accept or Cancel to confirm or cancel the operation.
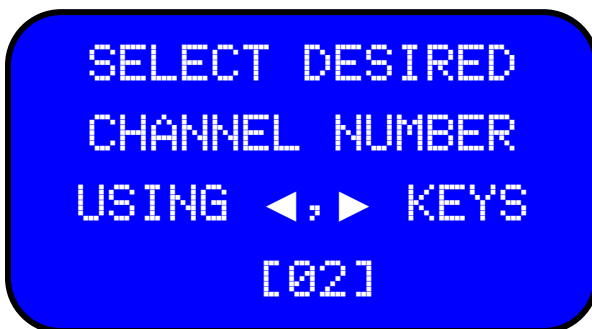
Note: Any channel other than the first channel can be deleted.

```
   EDIT CHANNEL
   SAVE CHANGES
  ►DELETE CHANNEL
  _____
```

Attempting to delete channels when no channel has been set, besides channel one, which is set by default, will result in the following warning message.

```
   THERE IS NOT
   ANY CHANNEL
  AVAILABLE FOR
  THIS INTENTION
```

If the channel chosen to be deleted is already set as active channel, the following message will be given:

```
  SELECT DESIRED
  CHANNEL NUMBER
  USING ◄,► KEYS
      [02]
```

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```
      WARNING!
  SELECTED PROFILE
    MAY BE LOST
  ACCEPT    CANCEL
```
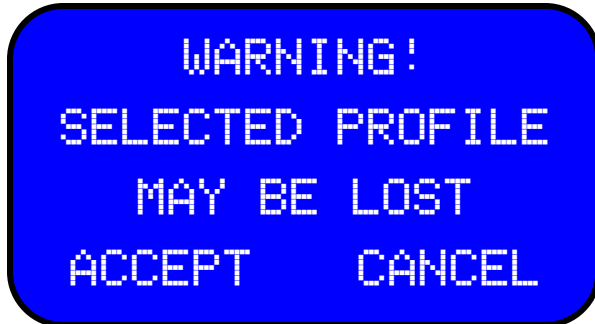
A message confirming the desired operation was successfully executed will be displayed.

```
       OPERATION
      WAS EXECUTED
      SUCCESSFULLY
   (HIT ENTER/BACK)
```
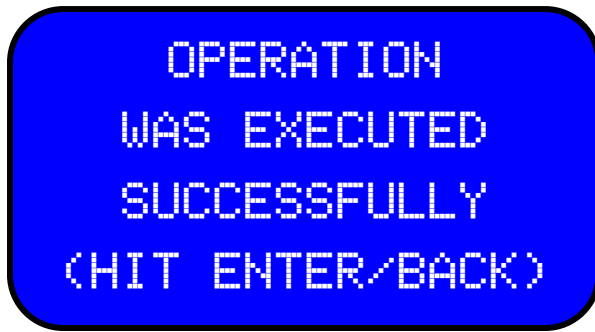
If the channel attempting to delete is the active channel, the following message will be displayed:

```
     ARE YOU SURE
     WANT TO DELETE
   ACTIVE CHANNEL?
   <YES>      <NO>
```
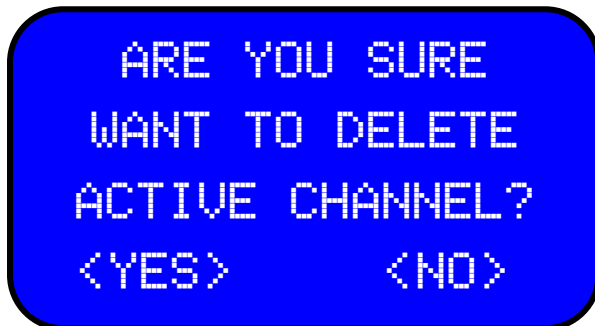
If the active channel is deleted, profile one will be automatically loaded, and an auto calibration will take place.

```
LOADING PROFILE
   IN PROGRESS
PLEASE WAIT  30
```

```
AUTO CALIBRATION
    IN PROGRESS
PLEASE   WAIT 15
.........
```

BACK can be applied to cancel or **ENTER** can be used to delete the selected channel. Once accepted to delete, a message confirming the desired operation was successfully executed will be given:

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
(HIT ENTER/BACK)
```

The delete function is not available if the lockout option is enabled.
If this device is already locked, attempting to select "DELETE CHANNEL" will produce the following message:

```
SELECTED FEATURE
IS NOT AVAILABLE
  AT THIS TIME
(HIT ENTER/BACK)
```

Refer to section 6.7 for lock settings and for further information how to set it enable or disable.

6.2 System Setting


```
     SENSOR PROFILE
  ▶ SYSTEM SETTING
     DATA LOGGING
     OUTPUT CONFIG
```
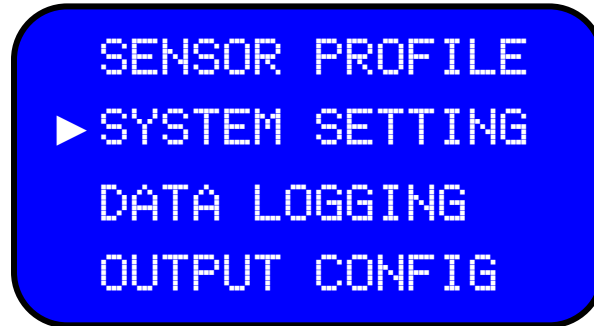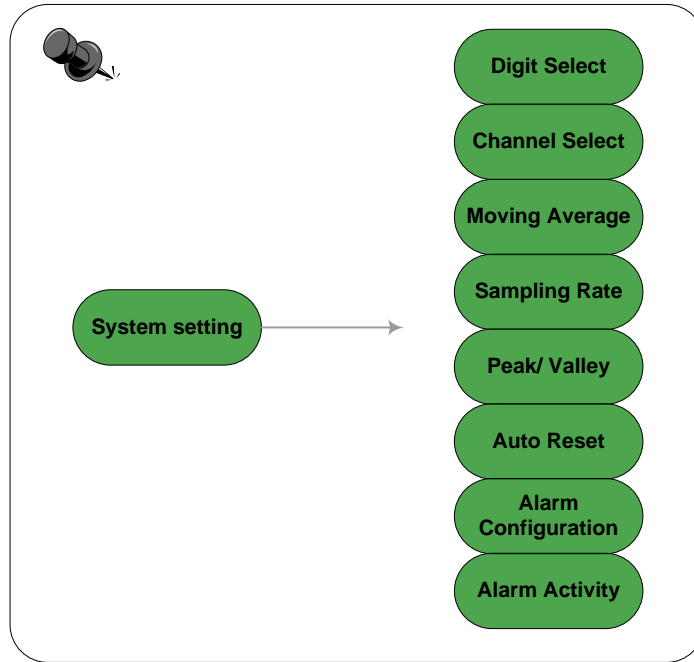
6.2.1   Digit Select

Scroll to "**DIGIT SELECT**" from "**SYSTEM SETTING**" using the▲▼ keys and press **ENTER**.

```
►DIGIT SELECT
 CHANNEL SELECT
 MOVING AVERAGE
 SAMPLING RATE
```

Use the◄► keys to select the number of digits from 3 to 6.

```
 SELECT DESIRED
 DISPLAY DIGITS
 USING ◄,► KEYS
      [6]
```

Once the desired number of digits has been selected, a prompt will appear prompting to set the value as a default value.

```
 WOULD YOU LIKE
   TO SAVE AS
    DEFAULT?
 <YES>    <NO>
```
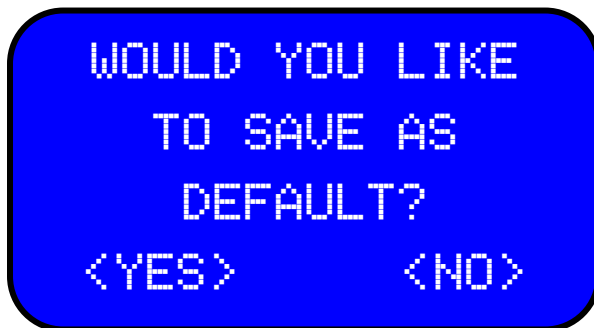
Select **EXIT** to return to the main page at any time.
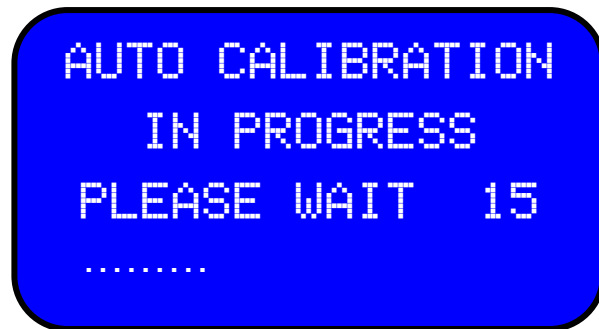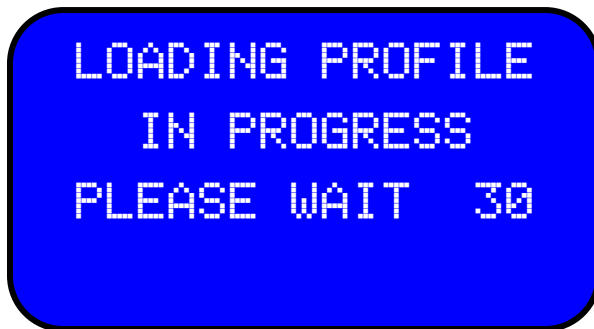Press **BACK** to go to the previous options at any time.

6.2.2   Channel Select

Scroll to "CHANNEL SELECT" from "SYSTEM SETTING" using the▲▼ keys and press ENTER.
Use the ◄► keys to select the desired number. If no other channels have been added, only channel 01
can be selected, which is the default channel.

```
     DIGIT SELECT
 ►  CHANNEL SELECT
     MOVING AVERAGE
     SAMPLING RATE
```

```
     SELECT DESIRED
     CHANNEL NUMBER
     USING ◄,► KEYS
          [01]
```

```
   LOADING PROFILE
      IN PROGRESS
   PLEASE WAIT  30
```

```
   AUTO CALIBRATION
      IN PROGRESS
   PLEASE WAIT  15
   .........
```
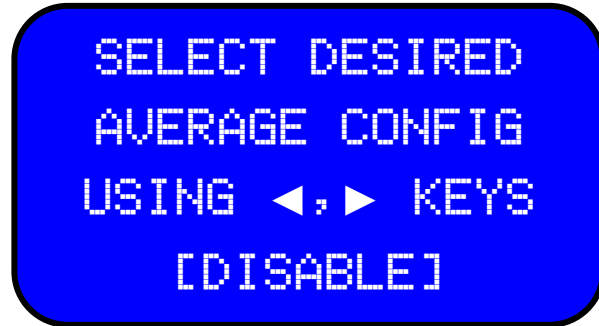
After selecting the desired channel, there is the option of setting it as the default channel. Use BACK to
select NO and return to the system setting option. By selecting YES, the selected channel will be set as the
default channel.

```
   WOULD YOU LIKE
      TO SAVE AS
       DEFAULT?
   <YES>     <NO>
```
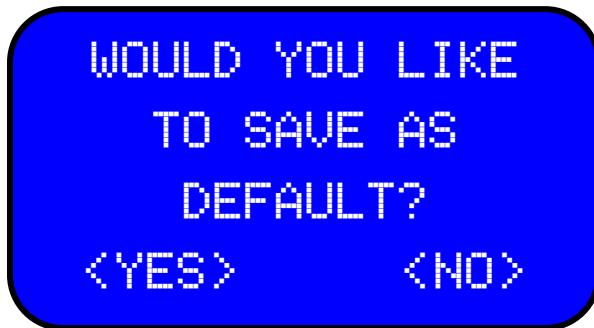
6.2.3 Moving Average

Scroll to "**MOVING AVERAGE**" from "**SYSTEM SETTING**" using the ▲ ▼ keys and press **ENTER.**
Using the ◄ ► keys: **disable**, **2**, **4**, **8**, **16**, **32**, **64**, or **128 can be selected**.

```
  DIGIT SELECT

  CHANNEL SELECT

►MOVING AVERAGE

  SAMPLING RATE
```

```
 SELECT DESIRED

 AVERAGE CONFIG

USING ◄,► KEYS

    [DISABLE]
```

After selecting the desired moving average settings, a prompt will be shown with the option of setting it as default. Use **BACK** to select NO and return to the system setting option. By selecting YES, the selected channel will be set as the default channel.

```
WOULD YOU LIKE

   TO SAVE AS

   DEFAULT?

<YES>      <NO>
```
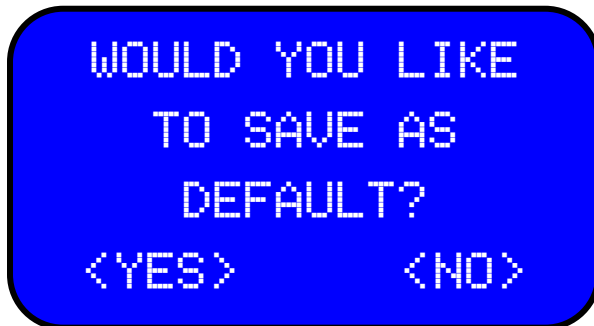
Average Measurements:

An average (Ave_n) is defined as the summation of n samples divided by n.

$$Ave_n = \frac{\sum_{i=1}^{n} Sample_i}{n}$$

(1)

For the kᵗʰ average, we have the following:

$$Ave_k = \frac{\sum_{i=1+k-n}^{k} Sample_i}{n}$$

(2)

This is known as a moving average because the average at each kth instant is based on the most recent set of n values. In other words, it is a moving window of n values that are used to calculate the average of the data sequence (see Figure 1).
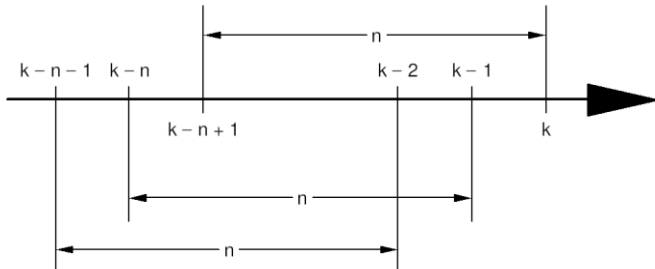
Figure 1: Moving Average of n Data Points

The averaging process can be improved if the calculations can be performed in a recursive fashion. Equation 1 can also be represented as the previous total of n – 1 samples plus the new sample, and then divided by n.

$$Ave_n = \frac{\sum_{i=1}^{n-1} Sample_i + Sample_n}{n} \tag{3}$$

Using Equation 1, we can derive the equation for Ave_{n-1}

$$Ave_{n-1} = \frac{\sum_{i=1}^{n-1} Sample_i}{n-1} \tag{4}$$

This can be rearranged as shown in Equation 5:

$$(n-1) \cdot Ave_{n-1} = \sum_{i=1}^{n-1} Sample_i \tag{5}$$

Using Equation 5, we can replace the value of $\sum_{i=1}^{n} Sample_i$ in equation 3 with $(n-1) \times Ave_{n-1}$ This yields Equation 6:

$$Ave_n = \frac{(n-1) \cdot Ave_{n-1} + Sample_n}{n} = \frac{n \cdot Ave_{n-1}}{n} - \frac{Ave_{n-1}}{n} + \frac{Sample_n}{n} \tag{6}$$

Equation 6 can be simplified to equation 7:

$$Ave_n = Ave_{n-1} + \frac{Sample_n - Ave_{n-1}}{n} \tag{7}$$

6.2.4   Sampling Rate

Scroll to "SAMPLING RATE" from "SYSTEM SETTING" using the ▲▼ keys and press **ENTER**. Using the ◄► keys, 16 different sampling rates can be selected in two different levels as listed below:
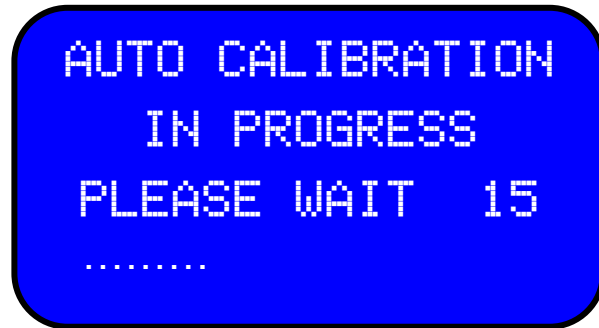
LOW SPEED: 5, 10, 25, 30, 50, 60, 100, 200, 400
HIGH SPEED: 600, 800, 960, 1200, 1600, 2400, 4800

Note: During the data logging, *Voltage output*, *Current output*, and *ASCII output* are disabled to get the maximum data.
See section 6.3 for more information about data logging.

```
  CHANNEL SELECT          SELECT DESIRED
  MOVING AVERAGE          SAMPLING RATE
 ►SAMPLING RATE           USING ◄,► KEYS
  PEAK / VALLEY              [5 SPS]
```

Whenever the sampling rate is changed the system will automatically load the active channel and perform an auto calibration followed by loading the active channel information.

```
  LOADING PROFILE         AUTO CALIBRATION
    IN PROGRESS              IN PROGRESS
  PLEASE WAIT  30         PLEASE WAIT  15
                          .........
```
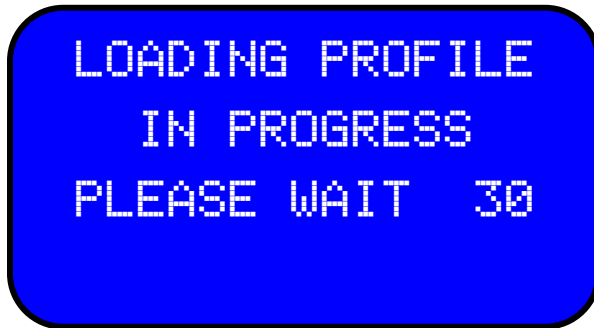
For bandwidth clarification, see APPENDIX C (DEVICE SPECIFICATIONS).

6.2.5   Peak/ Valley

Scroll to "PEAK/ VALLEY" from "SYSTEM SETTING" using the ▲▼ keys and press ENTER.

```
   CHANNEL SELECT
   MOVING AVERAGE
   SAMPLING RATE
  ►PEAK / VALLEY
```
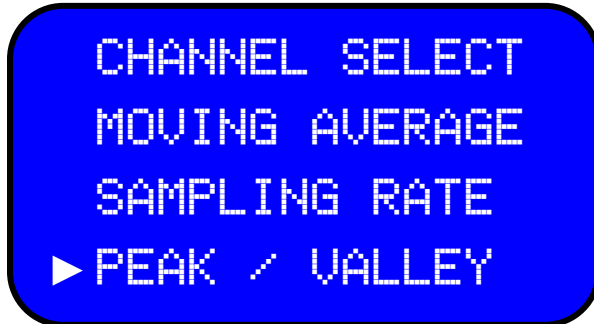
Using the ◄►keys select to display the First Peak/Valley or Hold Peak/Valley values.

```
   SELECT DESIRED
   CONFIGURATION
   USING ◄,► KEYS
       [HOLD]
```

A prompt will be shown to set this value as a default setting.

```
   WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
  <YES>     <NO>
```
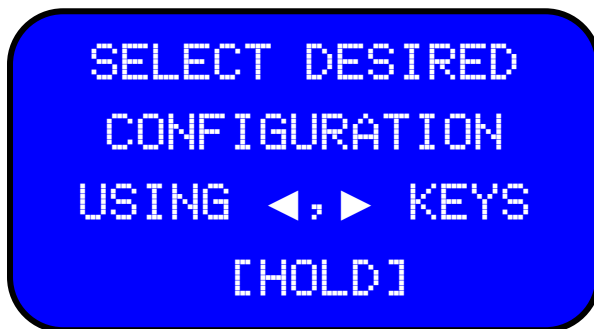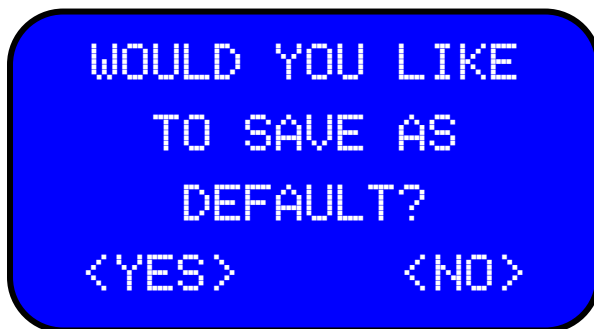
First Peak/First Valley mode will capture the first peak or valley and disregard the future inputs peak or valleys.
Peak Hold/Valley Hold mode will "Hold" on to the maximum (peak) and minimum (valley) values.

First peak and first valley will be captured based on the specified threshold values defined in the sensor profile. Refer to sections (6.1.3.10.1), (6.1.3.10.2), and (6.1.3.10.3) for more details.

Valley is the maximum absolute value in the negative direction.

6.2.6   Auto Reset

Scroll to "AUTO RESET" from "SYSTEM SETTING" using the ▲ ▼ and press ENTER.

Auto Reset will reset the peak and valley values when the timer is expired. The time, in seconds, is defined in the sensor profile. Refer to section (6.1.3.10.6) for more detail.

```
   SAMPLING RATE
   PEAK / VALLEY
 ►AUTO RESET
   ALARM CONFIG
```

Using the ◄ ► keys select to enable or disable the Auto Reset function.

```
   SELECT DESIRED
      ACTIVITY
   USING ◄,► KEYS

     [DISABLE]
```

A prompt will be shown to set this value as a default setting.

```
   WOULD YOU LIKE
      TO SAVE AS
      DEFAULT?
   <YES>     <NO>
```
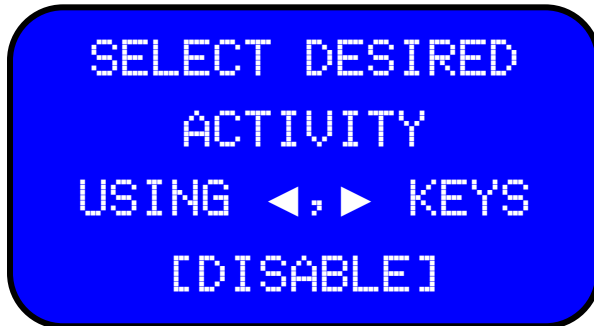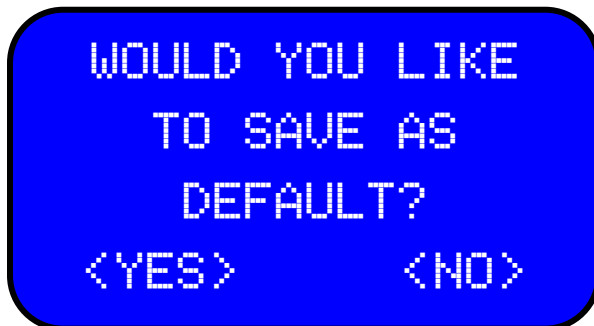
6.2.7 Alarm Configuration

Scroll to "**ALARM CONFIGURATION**" in "**SYSTEM SETTING**" using the▲▼ keys and press **ENTER**.

The Alarm threshold levels are set in the sensor profile (Refer to section 6.1.3.10), Refer to the drawings on page 50 for examples regarding alarm THD levels.

```
  SAMPLING RATE
  PEAK / VALLEY
  AUTO RESET
▶ ALARM CONFIG
```

Using the◀▶keys set the Alarm Configuration to Latched or Non-Latched.

Definitions:
Latched alarm: Holds the alarm activated until a reset function (manual reset or auto reset) is performed.
Non-Latched alarm: The alarm will turn OFF if the current value goes outside the alarm operating range (enters none alarm area).

```
  SELECT DESIRED
   ALARM CONFIG
  USING ◀,▶ KEYS
    [LATCHED]
```

```
  WOULD YOU LIKE
    TO SAVE AS
     DEFAULT?
  <YES>     <NO>
```

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ISO 9001:2008   ISO 17025:2005   U.S. Manufacturer
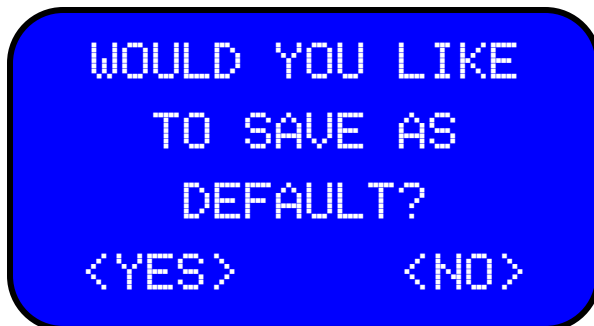
6.2.8   Alarm Activity

Scroll to "ALARM ACTIVITY" from "SYSTEM SETTING" using the ▲ ▼ keys and press ENTER.

```
    AUTO RESET
    ALARM CONFIG
  ►ALARM ACTIVITY
    .... .... .... .... .... .... .... .... .... .... .... ....
```
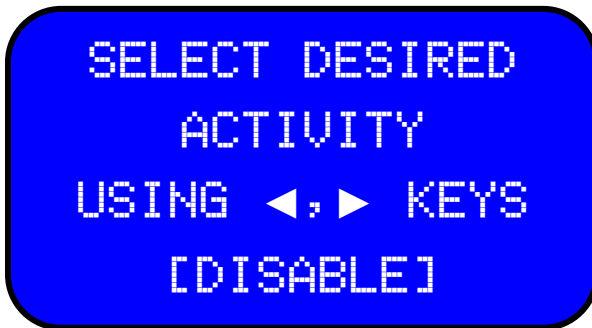
Using the ◄ ► keys different alarm activities including System Alarm or Relay Alarm can be either enabled or disabled.

```
  SELECT DESIRED
      ACTIVITY
  USING ◄,► KEYS
      [DISABLE]
```

A prompt will be shown to set this value as a default setting.

```
  WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
  <YES>      <NO>
```
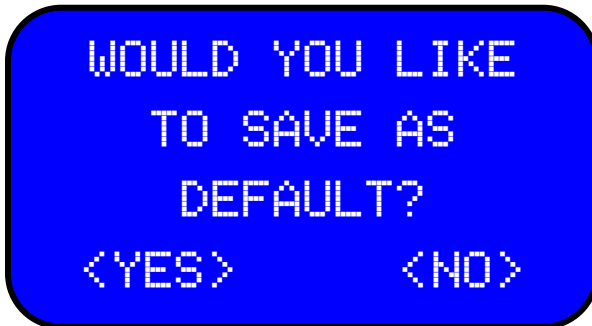
The Peak values will blink in intervals of 2.5 seconds if the current value exceeds the alarm high limit.
The Valley values will blink in intervals of 2.5 seconds if the current value is below the alarm low limit.

6.3 Data Logging


```
   SENSOR PROFILE
   SYSTEM SETTING
 ▶DATA LOGGING
   OUTPUT CONFIG
```
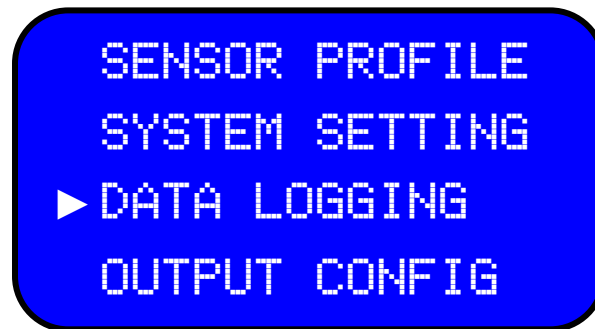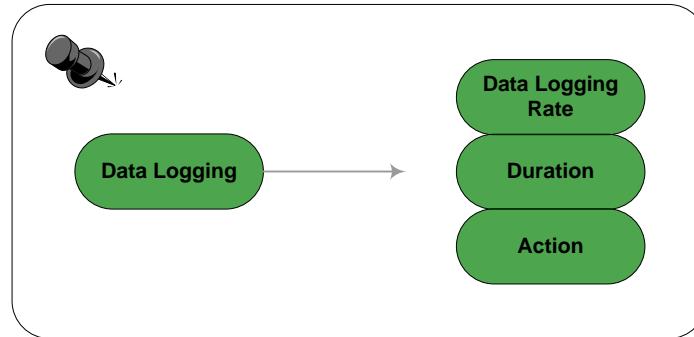
This menu option allows the user to log the data. Data logging is a useful feature to monitor the performance of sensor during a specific time. In order to take advantage of this feature the following factors should be considered before:

The Data Logging feature is not available if the timer has been expired or there is not enough memory location to support the defined time. Also if there is an attempt to try to use the Tare key while using this feature, a warning message will notify the user that this function is not available at this time.

IHH500 has 128 Kbytes internal buffer to log the data. This buffer has been partitioned to two areas for Tracking and Time values and each category has 24 bit data (3 bytes) allocated to it; which means that each one has capacity of 21,845 pieces of data. The final data packet time, is measured in millisecond. After data logging is completed, while the device is on and another data logging has not been established, the logged data is accessible by FUTEK data logging software, SENSIT Test and Measurement.

Note: Encoder information is not monitored during a data logging session.

6.3.1   Logging Rate

Scroll to "**LOGGING RATE**" from "**DATA LOGGING**" using the ▲▼ keys and press **ENTER**. Using the ◄► keys select either **HALF SPEED**, **FULL SPEED**. This setting can be set as a default setting.

```
   SELECT DESIRED
   LOGGING RATE
  USING ◄,► KEYS

   [HALF SPEED]
```

```
►LOGGING RATE
  DURATION (SEC)
  ACTION
  _____
```

```
  WOULD YOU LIKE
    TO SAVE AS
     DEFAULT?
 <YES>      <NO>
```

At full speed the IHH500 will use the current set sampling rate in the data logging session. At half speed, ½ of the current set sampling rate will be using in the data logging session.

6.3.2 Duration (SEC)

Scroll to "DURATION" from "DATA LOGGING" using the ▲ ▼ keys and press **ENTER**.
Use the ◄ ► and the ▲ ▼ keys to select the desired duration in seconds; therefore, from 0 to 9999 seconds can be selected.

```
 LOGGING RATE
▶DURATION(SEC)
 ACTION
 ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
```

```
 SELECT DESIRED
     VALUE
USING ARROW KEYS
    [0000]
```
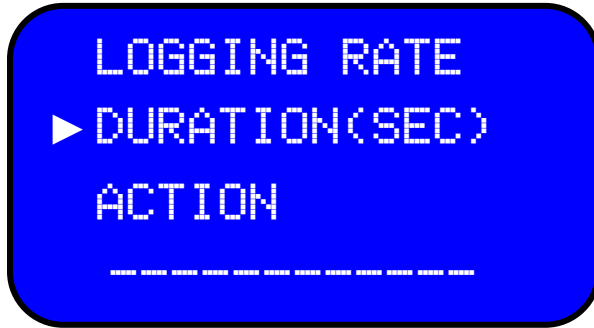
Note: The duration that can be set is limited by the following formula:

Max Duration (sec) = Integer (21845/ sampling rate)

SPS	5	10	25	30	50	60	100	200
Max D	4369	2184	873	728	436	364	218	109

| SPS	400	600	800	960	1200	1600	2400	4800
Max D	54	36	27	22	18	13	9	4

For example:
If the sampling rate has been set to 10 Samples per Second (SPS) the duration, in second, can be selected up to 2184.
In the case of HALF SPEED the duration time can be twice as long.

If the device has been set to 10 Samples per Second (SPC) and HALF SPEED logging rate is selected, the duration, in second, can be selected up to 4368.

Although any other numbers can be selected, after the actual maximum duration time, the internal buffer will hit full capacity and the following message will appear:

```
   DATA LOGGING
    PROCESS IS
    COMPLETED
  SUCCESSFULLY
```
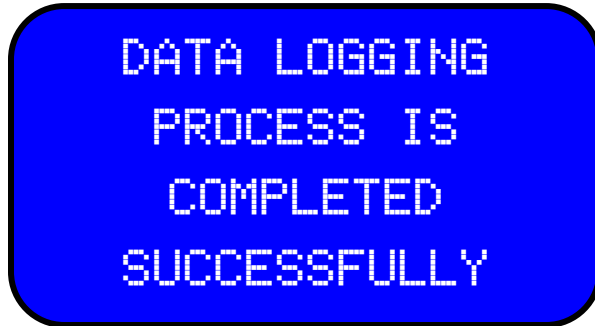
6.3.3   Action

Scroll to "ACTION" from "DATA LOGGING" using the ▲▼ keys and press ENTER.
Using the ◄►keys, the data logging session either can be started or stopped.
This sub menu allows the user to Stop or Start data logging process. As soon as the Start option is selected, the data logging process starts.

```
   LOGGING RATE
   DURATION (SEC)
 ▶ACTION

   ------------------
```
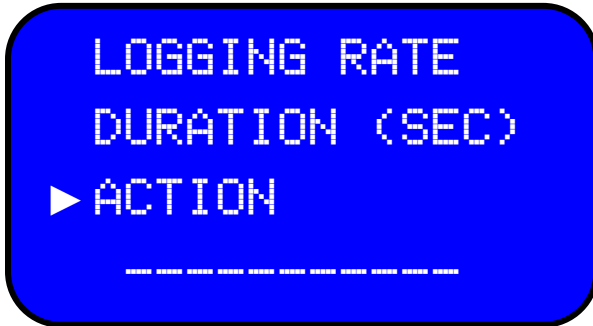
By pressing the ENTER key you can select to stop or start the data logging test.

```
   SELECT DESIRED
        ACTION
   USING ◄,▶ KEYS
       [START]
```

The following check mark will be displayed when the data logging session has begun.

```
   LOGGING RATE
   DURATION (SEC)
 ▶ACTION      ᴊ

   ------------------
```
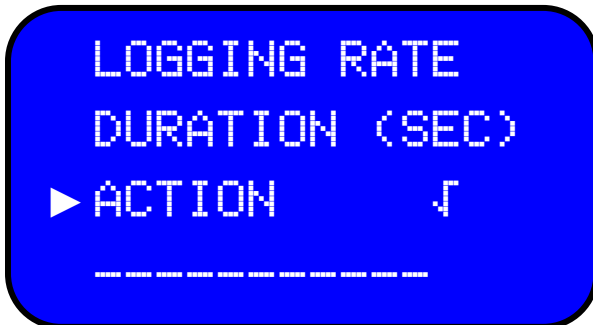
It is important to know that IHH500 is equipped by a high speed Processor.
This processor is responsible to control every single feature of device and dedicates the specific time frame for internal operation and Interfaces.
During a high speed data logging session (600, 800, 960, 1200, 1600, 2400 and 4800) the *Voltage output*, *Current output*, and *ASCII output* are internally disabled and the data logging menu cannot be left until the timer expires. This will force the processor to allocate more time frames to process the data from ADC, perform the calculation, and save the data into the internal buffer, however after completing the data logging session, the initial conditions will be restored.

```
   HIGH SPEED
  DATA LOGGING
   IN PROGRESS
  PLEASE WAIT
```

When performing data logging session at lower speed sampling rates below 600 sps, there is an option to exit the data logging screen and return to the main screen where the countdown timer shows the elapsed time.

```
+3.03461      Peak
+3.03460      mV/V
+1.59484     Valley
D.L.T.       12.5 S
```
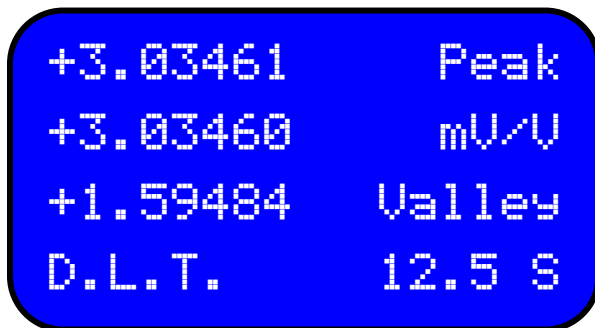
The following message will be displayed as soon as the data logging session has been completed.

```
 DATA LOGGING
   PROCESS IS
   COMPLETED
  SUCCESSFULLY
```
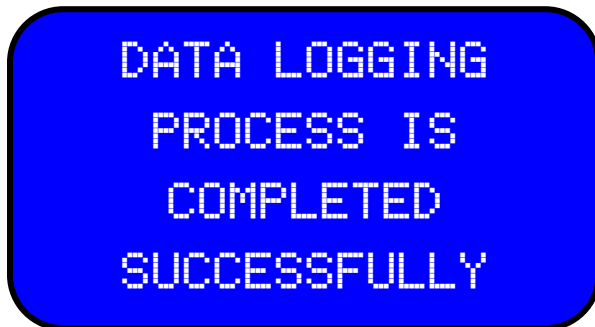
6.4 Output Configuration
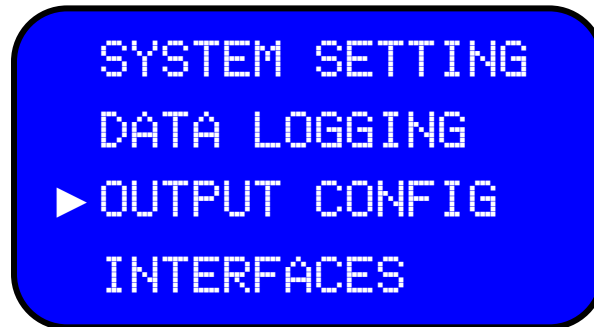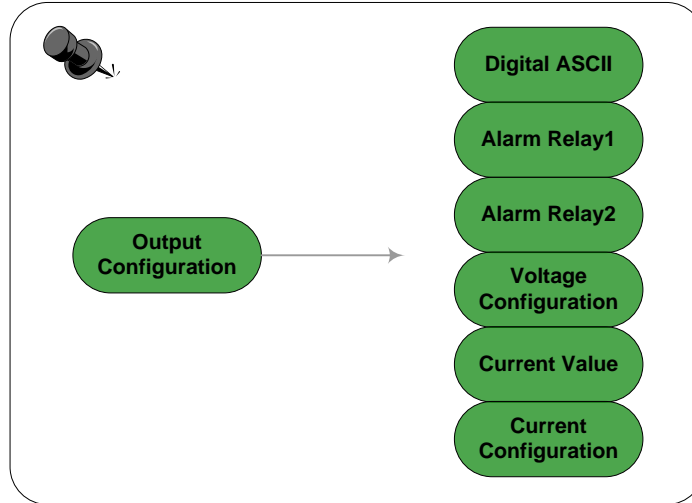
6.4.1   Digital ASCII

Scroll to "DIGITAL ASCII" from "OUTPUT CONFIG" using the ▲ ▼ keys and press ENTER.
ASCII output consists of four rows of data. Each row can be separated using following options:

- Carriage Return: carriage return (CR) is one of the control characters in ASCII code which moves the position of the cursor to the first position on the same line
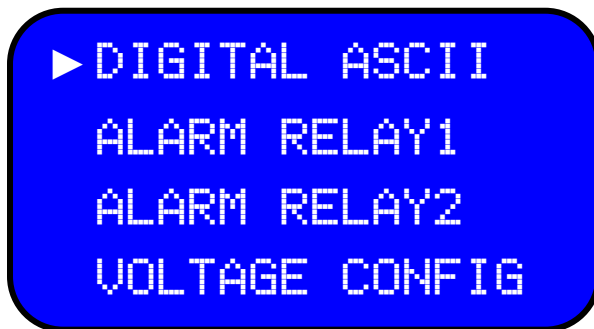- Line feed: moves the cursor on a display screen down one line.
- Carriage Return and line feed: moves to the next line, while carriage return precedes line feed to indicate a new line.
- Line feed and Carriage Return

```
▶DIGITAL ASCII
 ALARM RELAY1
 ALARM RELAY2
 VOLTAGE CONFIG
```

Use the ◄ ► keys and press ENTER to select CR, LF, LF & CR or LF & CR.

```
 SELECT DESIRED
TERMINATION CHAR
 USING ◄,► KEYS
    [CR+LF]
```

```
WOULD YOU LIKE
   TO SAVE AS
   DEFAULT?
<YES>    <NO>
```
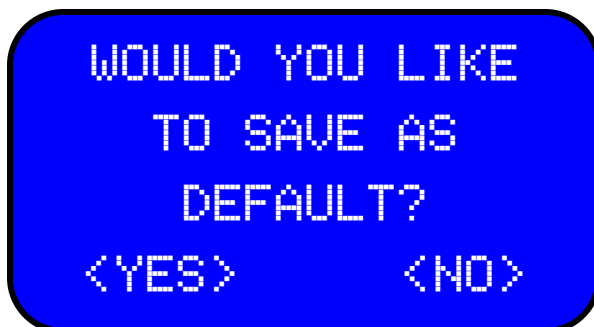
6.4.2   Alarm Relay 1

Alarm relay 1 is a solid state relay with a voltage / current rating of 110V/100mA. Alarm relay 1 has been mapped to alarm high. See section (6.2.8) to enable or disable alarm relay 1.

Scroll to "ALARM RELAY1" from "OUTPUT CONFIG" using the ▲ ▼ keys and press ENTER.
Use the ◄ ► keys to set the alarm relay 1 either to be normally open or normally close.

```
   DIGITAL ASCII
 ►ALARM RELAY1
   ALARM RELAY2
   VOLTAGE CONFIG
```

```
   SELECT DESIRED
    RELAY CONFIG
   USING  ◄,► KEYS
   [NORMALLY OPEN]
```

A prompt will be shown to set this value as a default setting.

```
   WOULD YOU LIKE
      TO SAVE AS
       DEFAULT?
   <YES>      <NO>
```
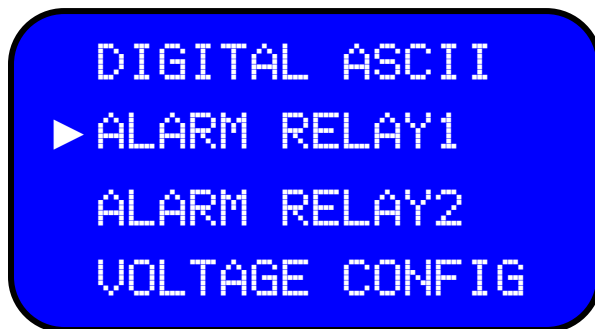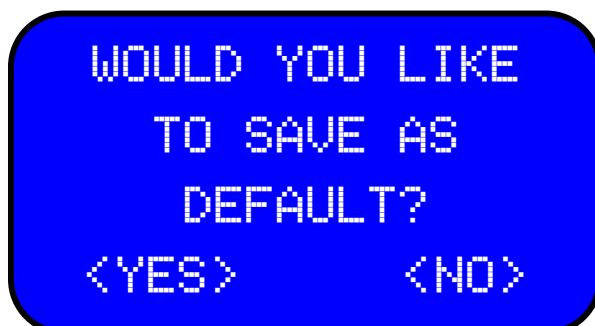
6.4.3   Alarm Relay 2

Alarm relay 2 is a solid state relay with a voltage / current rating of 110V/100mA. Alarm relay 2 has been mapped to alarm low.

Scroll to "ALARM RELAY2" from "OUTPUT CONFIG" using the ▲ ▼ keys and press **ENTER**.
Use the ◄ ► keys to set the alarm relay 2 either to be normally open or normally close.

```
   DIGITAL ASCII
   ALARM RELAY1
 ►ALARM RELAY2
   VOLTAGE CONFIG
```
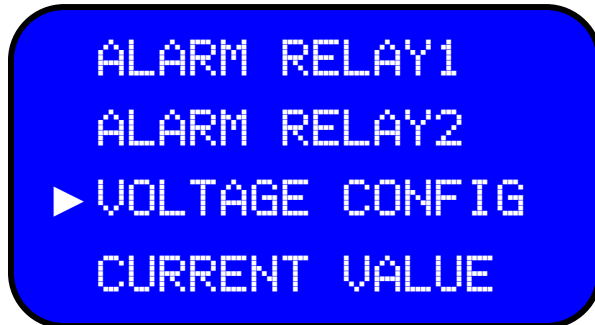
```
   SELECT DESIRED
    RELAY CONFIG
  USING  ◄,► KEYS
  [NORMALLY OPEN]
```

A prompt will be shown to set this value as a default setting.

```
  WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
  <YES>    <NO>
```

6.4.4   Voltage Configuration

Scroll to "VOLTAGE CONFIG" from "OUTPUT CONFIG" using the▲▼ keys and press ENTER.

```
   ALARM RELAY1
   ALARM RELAY2
 ▶VOLTAGE CONFIG
   CURRENT VALUE
```

Use the ◀▶ keys to select uni-polar which is 0 to 5 volts (negative full scale is mapped to 0 VDC, zero load is mapped to 2.5 VDC and plus full scale is mapped to +5V) or bipolar which is -5 VDC to 5 VDC (negative full scale is mapped to -5 VDC, zero load is mapped to 0 VDC and plus full scale is mapped to +5VDC).

```
  SELECT DESIRED
  VOLTAGE CONFIG
  USING  ◀,▶ KEYS
    [BI-POLAR]
```

A prompt will be shown to set this value as a default setting.

```
  WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
  <YES>     <NO>
```

6.4.5   Current Value

Scroll to "CURRENT VALUE" from "OUTPUT CONFIGURATION" using the ▲▼ keys and press
ENTER to define the current value.

```
      ALARM RELAY2
      VOLTAGE CONFIG
   ▶  CURRENT VALUE
      CURRENT CONFIG
```
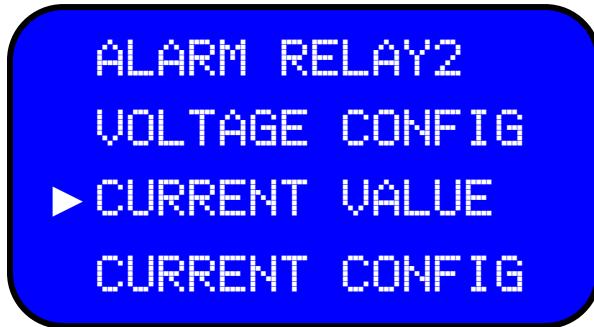
Use the ◀▶ keys and press ENTER to select any of the following Ranges: 0-20 mA, 4-20 mA, 0-25 mA or
5-25 mA.

```
      SELECT DESIRED
      CURRENT VALUE
      USING ◀,▶ KEYS
         [0-20 mA]
```

A prompt will be shown to set this value as a default setting.

```
      WOULD YOU LIKE
         TO SAVE AS
          DEFAULT?
      <YES>      <NO>
```
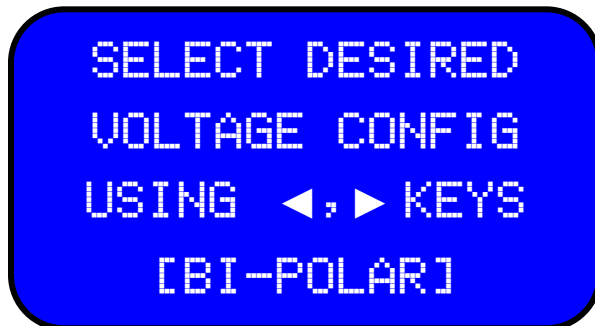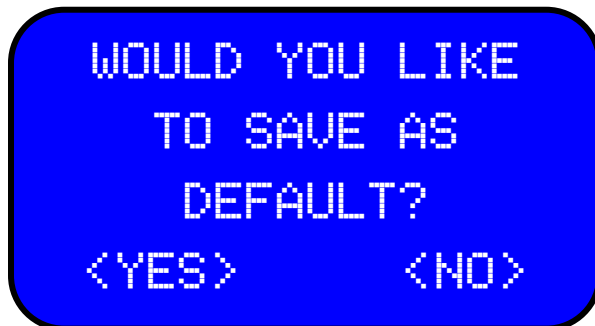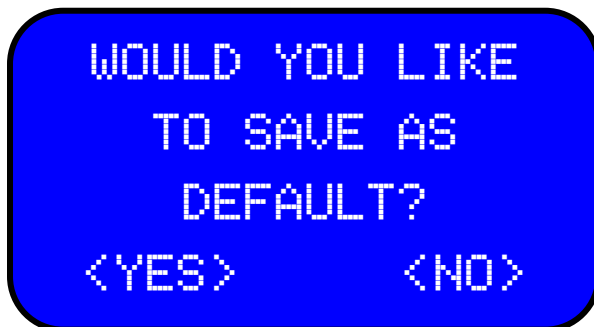
6.4.6   Current Configuration

Scroll to "CURRENT CONFIG" from "OUTPUT CONFIG" using the▲▼ keys and press **ENTER**.
Use the◄► keys to select either UNIDIRECTIONAL or BIDIRECTIONAL

- For a Bi-Directional configuration the, negative full scale output from the sensor is mapped to the lowest value of current. A zero load output from the sensor is mapped to the middle value and the positive full scale output from the sensor is mapped to the highest value of current. For example if 4-20 mA is selected, the sensor's negative full scale output is mapped to 4 mA, the zero load output from the sensor is mapped to 12 mA, and the sensor positive full scale output is mapped to 20 mA.
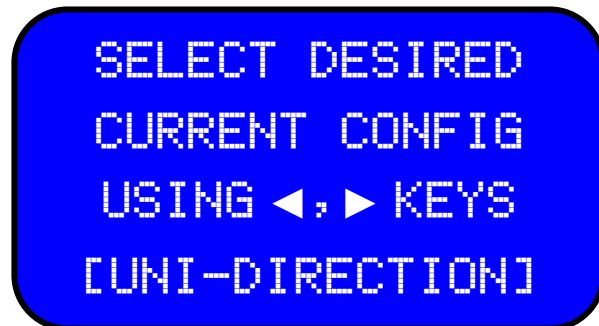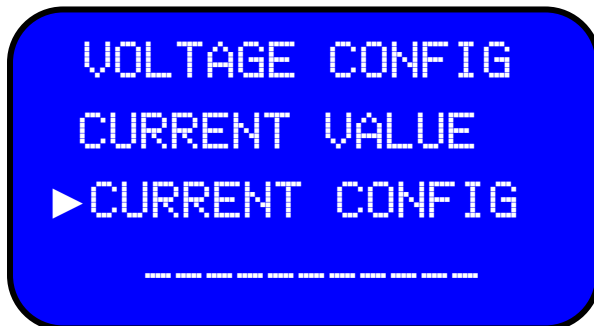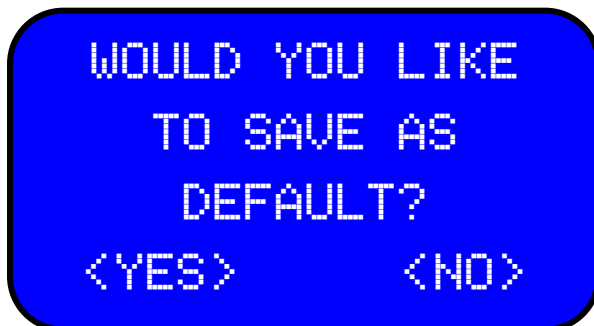
   This configuration is recommended for bidirectional sensors.

- For a Unidirectional configuration, the zero load output from the sensor is mapped to the lowest value of current and the sensor's positive full scale output is mapped to the highest value of current. For example if 4-20 mA is selected, the zero load output from the sensor is mapped to 4 mA, and sensor's positive full scale output is mapped to 20 mA. For negative values of load, output current decreases until reach 0 mA.
- This configuration is recommended for unidirectional sensors in order to obtain more resolution.

```
VOLTAGE CONFIG
CURRENT VALUE
►CURRENT CONFIG
_____
```

```
SELECT DESIRED
CURRENT CONFIG
USING ◄,► KEYS
[UNI-DIRECTION]
```

A prompt will be shown to set this value as a default setting.

```
WOULD YOU LIKE
TO SAVE AS
DEFAULT?
<YES>      <NO>
```
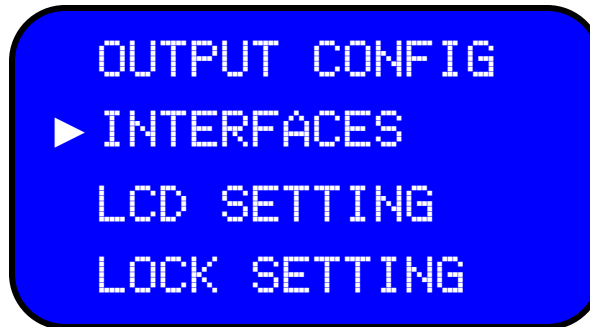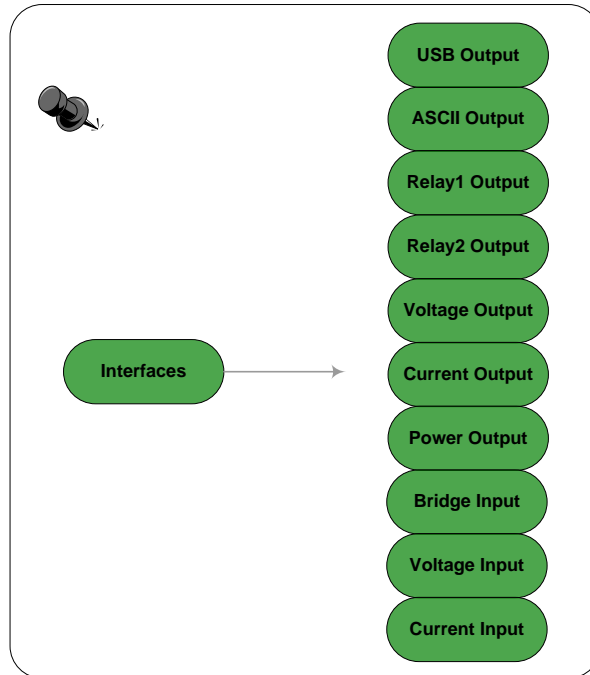
6.5   Interfaces

The following can be either enabled or disabled under the Interfaces menu:
USB output, ASCII output, Relay 1 output, Relay 2 output, Voltage output, Current output, Power output, Bridge input, Voltage input, and Current input. A check mark next to the item indicates that item has been activated.

Output enable: This feature enables a 24 V/1W power supply to be used as an excitation voltage (power supply) for an amplified sensor which requires an external power supply. It is highly recommended to disable this feature when a bridge type sensor is connected to the IHH500.

Using this feature will enable the internal DC-DC converter, thus providing high voltage. It should be noted that the battery discharges faster when working with amplified sensors.

6.5.1 USB Output

Scroll to "USB OUTPUT" from "INTERFACE" using the▲▼ keys and press ENTER.

```
▶USB OUTPUT√
  ASCII OUTPUT
  RELAY1 OUTPUT
  RELAY2 OUTPUT
```
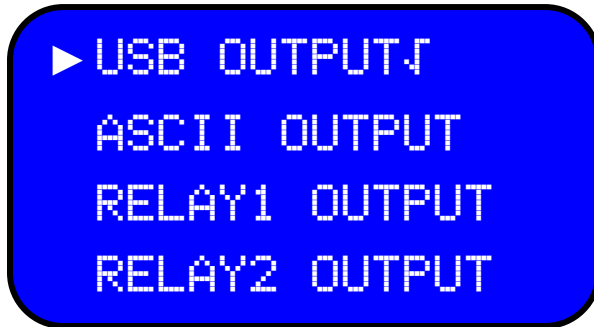
Use the◄►keys to either enable or disable the USB output activity.

```
SELECT DESIRED
   ACTIVITY
USING ◄,► KEYS
   [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
WOULD YOU LIKE
  TO SAVE AS
  DEFAULT?
<YES>     <NO>
```
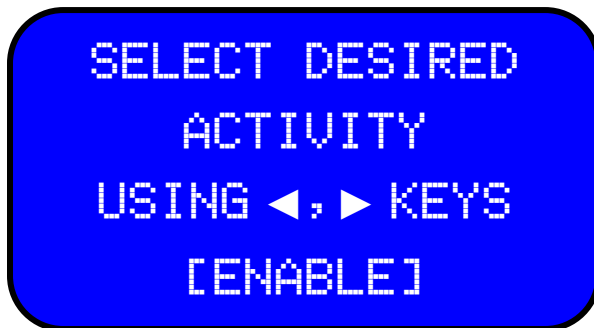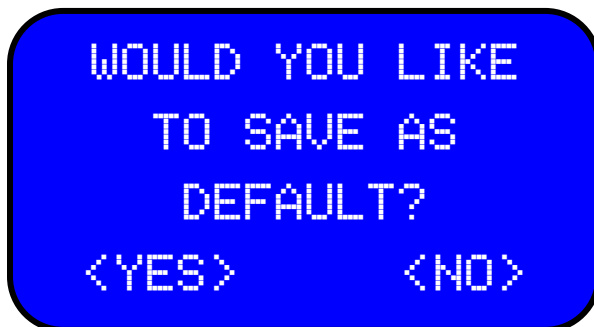
Whenever the USB Output is enabled a check mark showing that this feature is enabled will be seen on the display.

6.5.2   ASCII output

Scroll to "**ASCII OUTPUT**" from "**INTERFACE**" using the▲▼ keys and press **ENTER**.

```
   USB OUTPUT√
 ►ASCII OUTPUT
   RELAY1 OUTPUT
   RELAY2 OUTPUT
```
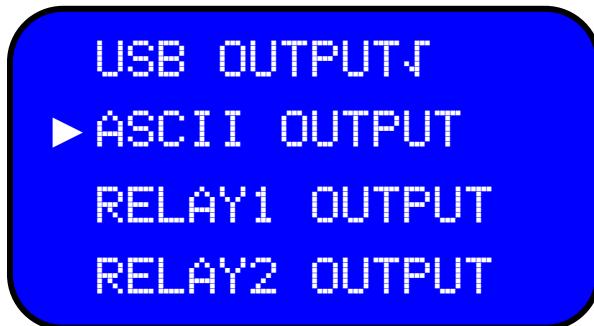
Use the◄► keys to either enable or disable the ASCII output.
The termination character configuration should be set in the Digital ASCII menu within the Output Config menu. Refer to section (6.4.1) for more details.

The ASCII output is disabled when the IHH500 sends and receives packet information from the computer.

```
 SELECT DESIRED
    ACTIVITY
 USING ◄,► KEYS
    [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
 WOULD YOU LIKE
    TO SAVE AS
    DEFAULT?
 <YES>      <NO>
```

Whenever the ASCII Output is enabled a check mark showing that this feature is enabled will be seen on the display.

6.5.3   Relay 1 Output

Scroll to "RELAY1 OUTPUT" from "INTERFACE" using the ▲ ▼ keys and press ENTER.

```
  USB OUTPUT√
  ASCII OUTPUT
 ►RELAY1 OUTPUT
  RELAY2 OUTPUT
```
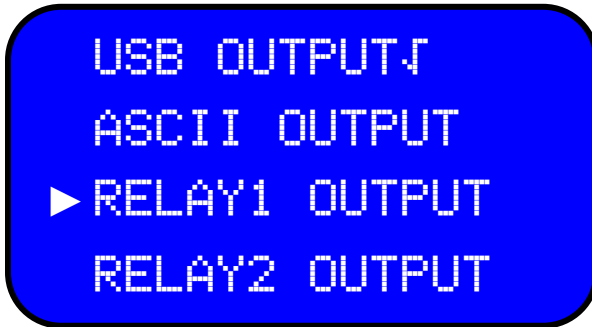
Use the ◄ ► keys to enable or disable Relay 1 output.

The configuration of the Relay 1 Output should be set under the output configuration menu. Refer to section (6.4.2) for more details.

Relay 1 is mapped to alarm high and will be affected by the alarm settings under the system setting menu. Refer to section (6.2.8) for more details on alarm activity.

```
  SELECT DESIRED
     ACTIVITY
  USING ◄,► KEYS
     [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
  WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
 <YES>      <NO>
```

Whenever the Relay 1 Output is enabled a check mark showing that this feature is enabled will be seen on the display.
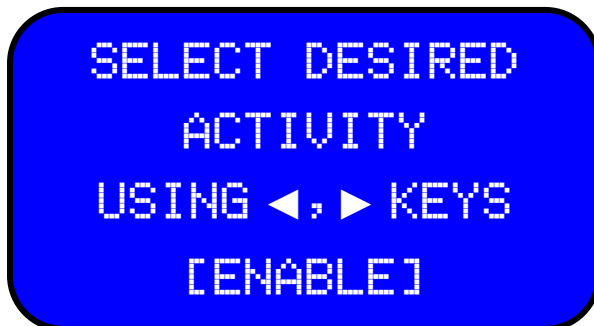
6.5.4   Relay 2 Output

Scroll to "RELAY OUTPUT2" from "INTERFACE" using the▲ ▼ keys and press **ENTER.**

```
  ASCII OUTPUT
  RELAY1 OUTPUT
 ▶RELAY2 OUTPUT
  VOLTAGE OUTPUT
```
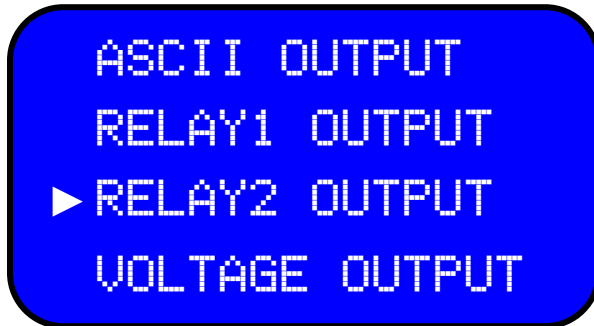
Use the ◀ ▶ keys to either disable or enable the Relay 2.

The configuration of the Relay 2 Output should be set under the output config menu. Refer to section (6.4.3) for more details.

Relay 2 is mapped to alarm low and will be affected by the alarm settings under the system settings menu. Refer to section (6.2.8) for more details.

```
 SELECT DESIRED
    ACTIVITY
 USING ◀,▶ KEYS
    [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
 WOULD YOU LIKE
    TO SAVE AS
    DEFAULT?
 <YES>     <NO>
```

Whenever the Relay 2 Output is enabled a check mark showing that this feature is enabled will be seen on the display.

6.5.5 Voltage Output

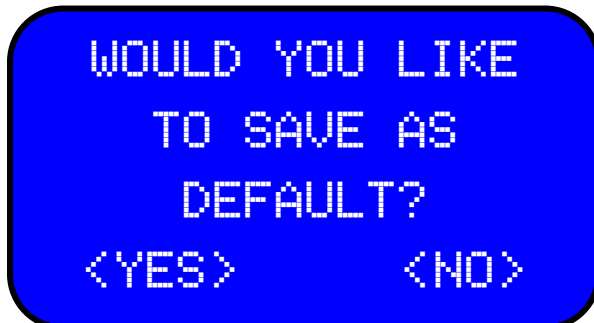Scroll to "**VOLTAGE OUTPUT**" from "**INTERFACE**" using the▲▼ keys and press **ENTER**.

```
    RELAY1 OUTPUT
    RELAY2 OUTPUT
  ▶ VOLTAGE OUTPUT
    CURRENT OUTPUT
```
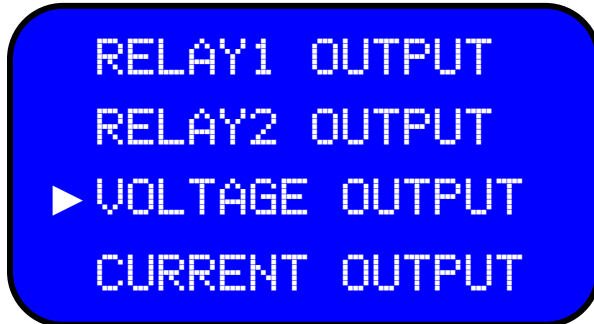
Use the◄► keys to either disable or enable the Voltage Output activity.

The configuration of the Voltage Output should be set under the output config menu. Refer to section (6.4.4) for more details.

```
   SELECT DESIRED
      ACTIVITY
   USING ◄,► KEYS
      [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
   WOULD YOU LIKE
      TO SAVE AS
      DEFAULT?
   <YES>      <NO>
```
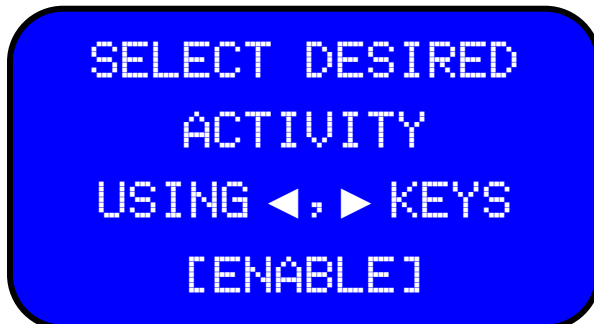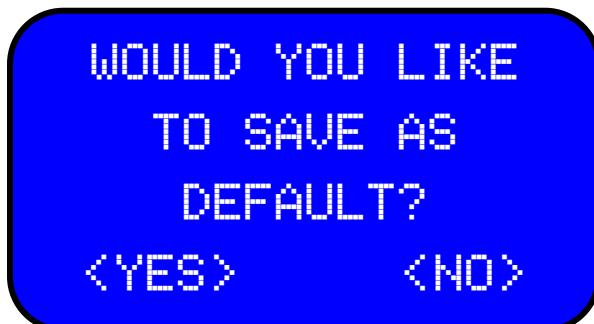
Whenever the Voltage Output is enabled a check mark showing that this feature is enabled will be seen on the display.
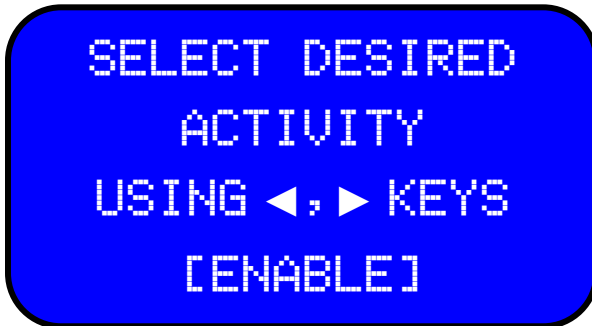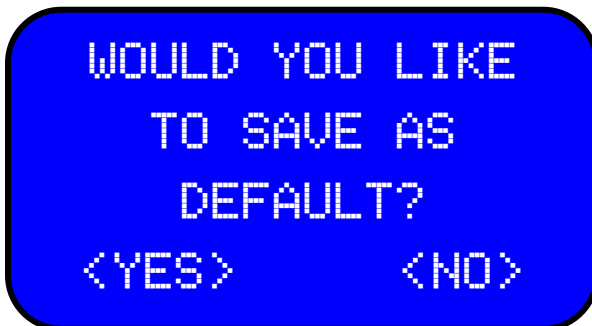
6.5.6   Current Output

Scroll to "**CURRENT OUTPUT**" from "**INTERFACE**" options using the ▲▼ keys and press **ENTER**.

```
   RELAY2 OUTPUT
   VOLTAGE OUTPUT
 ▶ CURRENT OUTPUT
   POWER OUTPUT
```
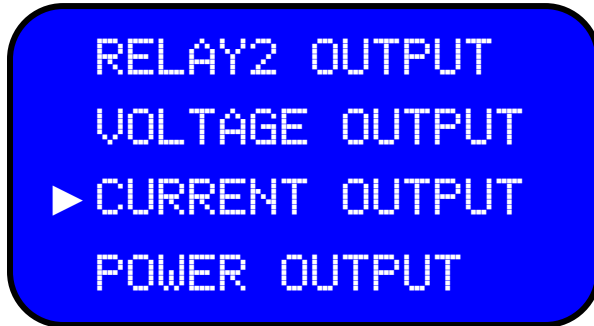
Use the ◀▶ keys on to either disable or enable the Current Output.

The configuration of the Current Output should be set under the output config menu. Refer to section (6.4.5) for more details.

```
   SELECT DESIRED
      ACTIVITY
   USING ◀,▶ KEYS
     [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
   WOULD YOU LIKE
      TO SAVE AS
      DEFAULT?
   <YES>     <NO>
```
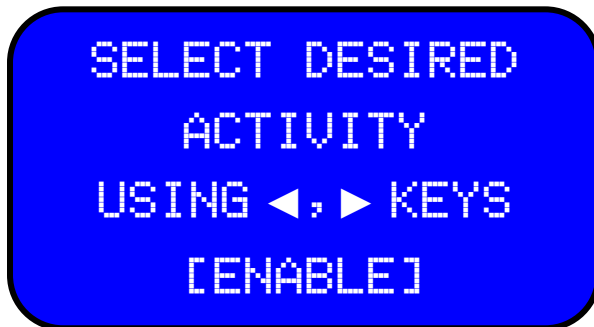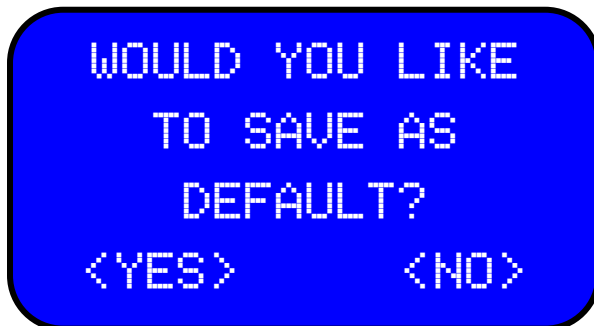
Whenever the Current Output is enabled a check mark showing that this feature is enabled will be seen on the display.

6.5.7 Power Output

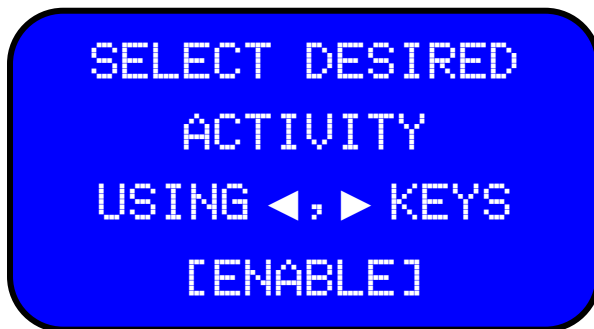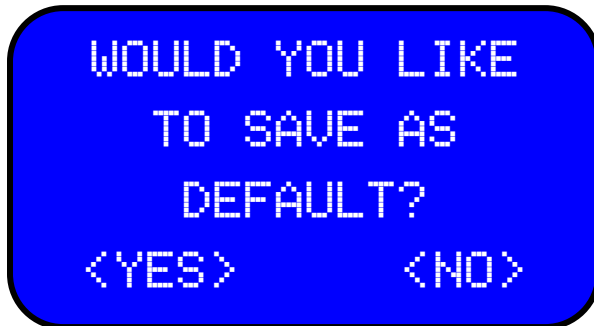Scroll to "POWER OUTPUT" from "INTERFACE" options using the ▲ ▼ keys and press **ENTER**.

```
   VOLTAGE OUTPUT
   CURRENT OUTPUT
  ▶POWER OUTPUT
   BRIDGE INPUT
```
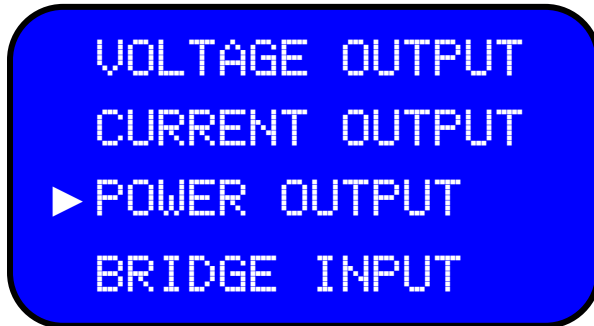
Use the ◀ ▶ keys to either disable or enable the Power Output.

```
  SELECT DESIRED
     ACTIVITY
  USING ◀,▶ KEYS
     [ENABLE]
```
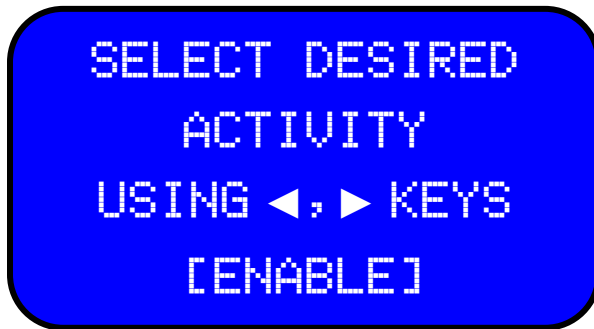
Depending on the type of sensor that has already defined in the current sensor profile, a warning message will be displayed when attempting to enable an input type which is not matched with the sensor configuration. For example, if the active channel 2 is defined as a bridge input the following warning message will appear on the screen when activating the Power Output:

```
     WARNING!
  EXISTING SETTING
   MAY BE CHANGED
  ACCEPT    CANCEL
```
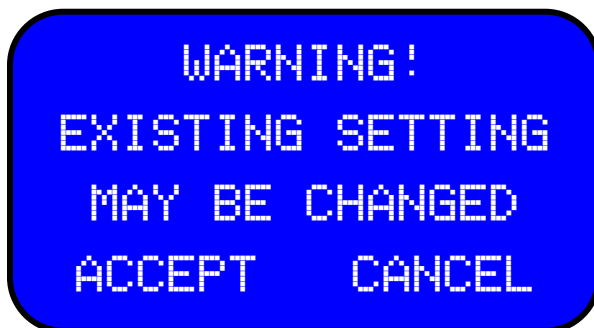
Whenever the Power Output is enabled a check mark showing that this feature is enabled will be seen on the display.

Important notice: Bridge sensors are internally connected to input number 1, current sensors are connected to input number 2 and voltage sensors are connected to input number 3. Enabling a different type of input can result in incorrect measurements.

6.5.8   Bridge Input

Scroll to "**BRIDGE INPUT**" from "**INTERFACE**" using the▲▼ keys and press **ENTER**.

```
   CURRENT OUTPUT
   POWER OUTPUT
 ►BRIDGE INPUT
   VOLTAGE INPUT
```

Use the◄► keys to either enable or disable the Bridge Input.
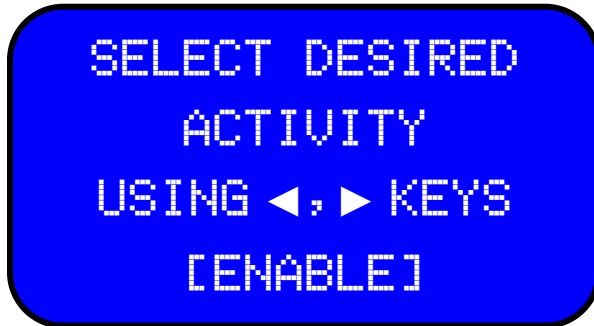
```
   SELECT DESIRED
      ACTIVITY
   USING ◄,► KEYS
      [ENABLE]
```

Depending on the type of sensor defined in the current sensor profile, a warning message will be displayed when attempting to enable an input type which is not matched with the sensor configuration. *For example,* if the active channel is defined as a bridge input the following warning message will appear on the screen when activating a different input setting:

```
      WARNING!
   EXISTING SETTING
   MAY BE CHANGED
   ACCEPT    CANCEL
```
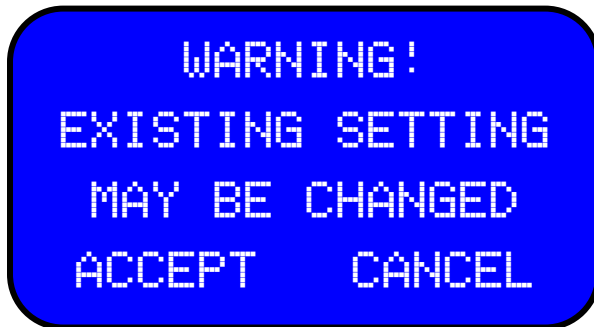
Whenever the Bridge Input is enabled a check mark showing that this feature is enabled will be seen on the display.

Important notice: Bridge sensors are internally connected to input number 1, current sensors are connected to input number 2 and voltage sensors are connected to input number 3. Enabling a different type of input can result in incorrect measurements.

6.5.9   Voltage Input

Scroll to "VOLTAGE INPUT" from "INTERFACE" using the▲ ▼ keys and press **ENTER**.

```
   POWER OUTPUT
   BRIDGE INPUT
 ►VOLTAGE INPUT
   CURRENT INPUT
```

Use the◄ ► keys to either disable or enable the voltage input.

```
  SELECT DESIRED
     ACTIVITY
  USING ◄,► KEYS
     [ENABLE]
```

Depending on the type of sensor defined in the current sensor profile, a warning message will be displayed when attempting to enable an input type which is not matched with the sensor configuration. *For example,* if the active channel is defined as a bridge input the following warning message will appear on the screen when activating a different input setting:

```
    WARNING!
 EXISTING SETTING
 MAY BE CHANGED
ACCEPT    CANCEL
```

Whenever the Voltage Input is enabled a check mark showing that this feature is enabled will be seen on the display.

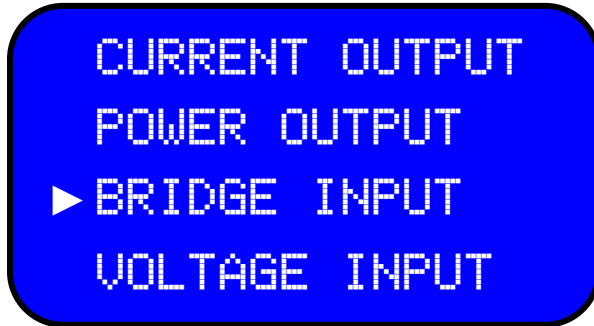*Important notice*: Bridge sensors are internally connected to input number 1, current sensors are connected to input number 2 and voltage sensors are connected to input number 3. Enabling a different type of input can result in incorrect measurements.

6.5.10   Current Input

Scroll to "CURRENT INPUT" from "INTERFACE" using the▲▼ keys and press ENTER.
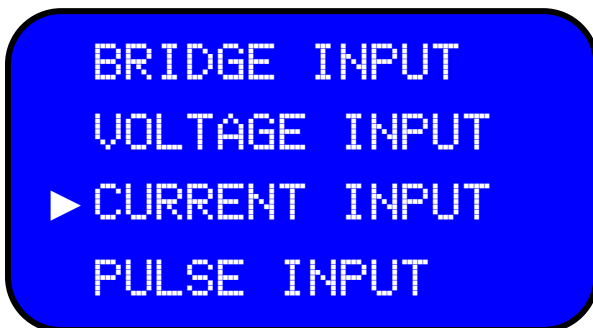
```
  BRIDGE INPUT
  VOLTAGE INPUT
 ►CURRENT INPUT
  PULSE INPUT
```

Use the ◄►keys to either disable or enable the Current Input.

```
 SELECT DESIRED
     ACTIVITY
 USING ◄,► KEYS
    [ENABLE]
```

Depending on the type of sensor defined in the current sensor profile, a warning message will be displayed when attempting to enable an input type which is not matched with the sensor configuration.

For example, if the active channel is defined as a bridge input the following warning message will appear on the screen when activating a different input setting:

```
      WARNING!
  EXISTING SETTING
   MAY BE CHANGED
 ACCEPT    CANCEL
```

Whenever the Current Input is enabled a check mark showing that this feature is enabled will be seen on the display.

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6.5.11 Pulse Input (This feature is available in Elite Version only)

Scroll to "**PULSE INPUT**" from "**INTERFACE**" using the ▲ ▼ keys and press **ENTER**.

```
 VOLTAGE INPUT

 CURRENT INPUT

►PULSE INPUT

 ---- ---- ---- ---- ---- ---- ---- ---- ----
```
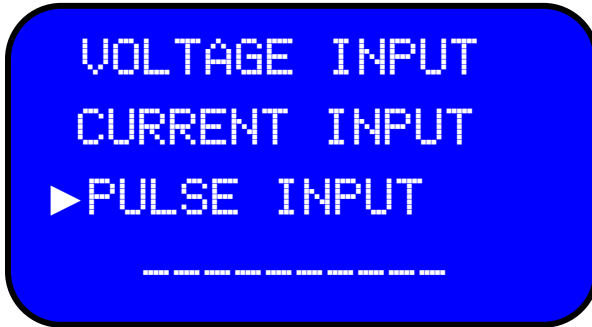
Use the ◄► keys to either disable or enable the Pulse Input.
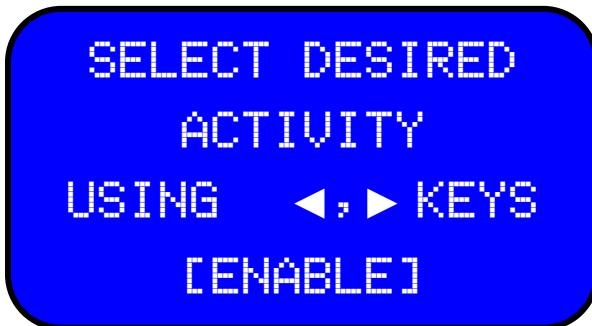
```
SELECT DESIRED

   ACTIVITY

USING   ◄,► KEYS

   [ENABLE]
```

Depending on the type of sensor defined in the current sensor profile, a warning message will be displayed when attempting to enable an input type which is not matched with the sensor configuration. *For example,* if the active channel is defined as a bridge input the following warning message will appear on the screen when activating a different input setting:
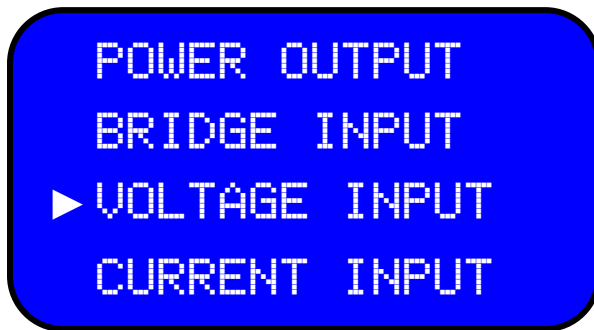
```
   WARNING!

EXISTING SETTING

 MAY BE CHANGED

ACCEPT   CANCEL
```
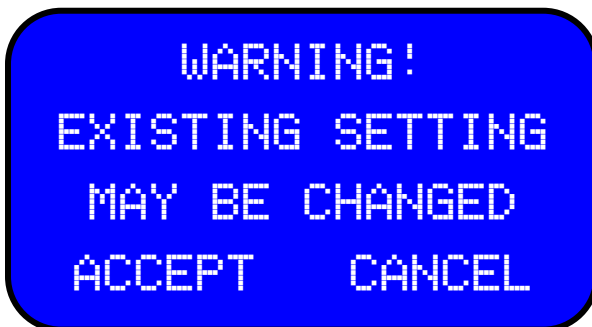
Whenever the Pulse Input is enabled a check mark showing that this feature is enabled will be seen on the display.

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ISO 9001:2008   ISO 17025:2005   U.S. Manufacturer
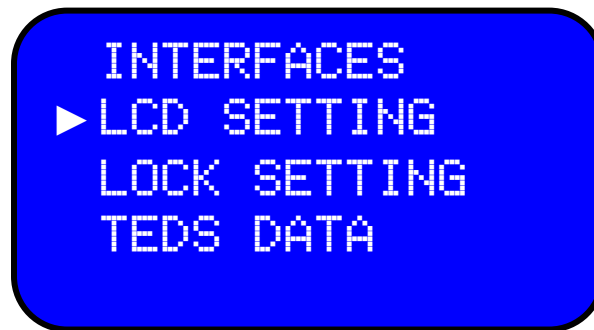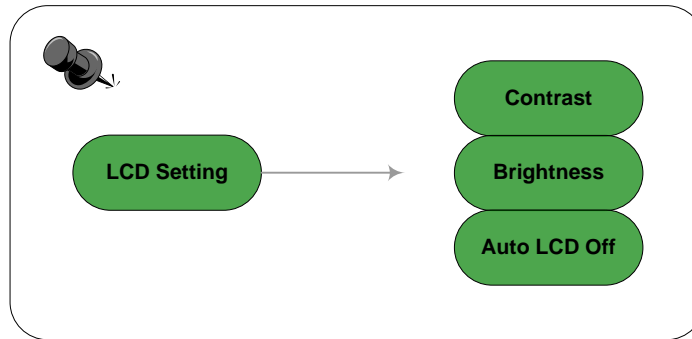
6.6   LCD Setting

6.6.1 Contrast

Scroll to "CONTRAST" from "LCD SETTING" using the ▲ ▼ keys and press **ENTER**.

```
►CONTRAST
  BRIGHTNESS
  AUTO LCD OFF
  _____
```

Use the ◄ ► keys to select the desired LCD contrast level.

```
SELECT DESIRED
    CONTRAST
USING ◄ ,► KEYS

======
```

A prompt will be shown to set this value as a default setting.

```
WOULD YOU LIKE
   TO SAVE AS
   DEFAULT?
<YES>     <NO>
```
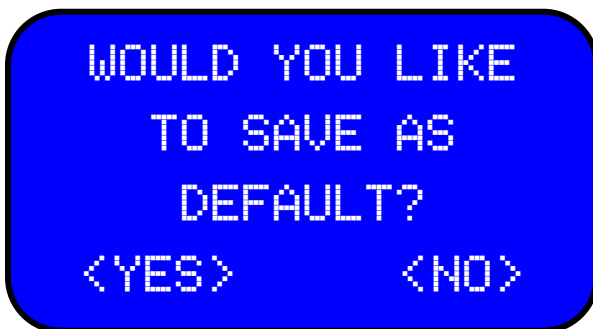
6.6.2   Brightness

Scroll to "**BRIGHTNESS**" from "**LCD SETTING** "using the ▲ ▼ keys and press **ENTER**.

```
   CONTRAST
 ▶ BRIGHTNESS
   AUTO LCD OFF
   ___ ___ ___ ___ ___ ___ ___ ___ ___
```

Use the ◀ ▶ keys to select the desired LCD brightness level.

```
   SELECT DESIRED
     BRIGHTNESS
  USING ◀ ,▶ KEYS
  ======
```

The desired Brightness can be saved as default.

```
  WOULD YOU LIKE
     TO SAVE AS
      DEFAULT?
  <YES>     <NO>
```
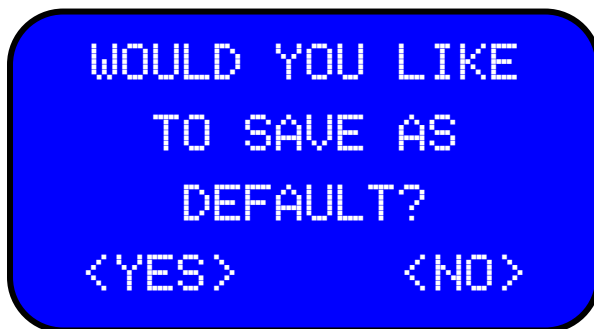
6.6.3   Auto LCD off

Scroll to "**AUTO LCD OFF**" from the "**LCD SETTING**" using the ▲▼ keys and press **ENTER**.

```
   CONTRAST
   BRIGHTNESS
 ►AUTO LCD OFF
   ___ ___ ___ ___ ___ ___ ___ ___ ___
```

Use the ◄► keys to Enable or Disable the Auto LCD Off feature. The Auto LCD Off timer can be set for 1-15min, after which the LCD will turn off if left unattended.
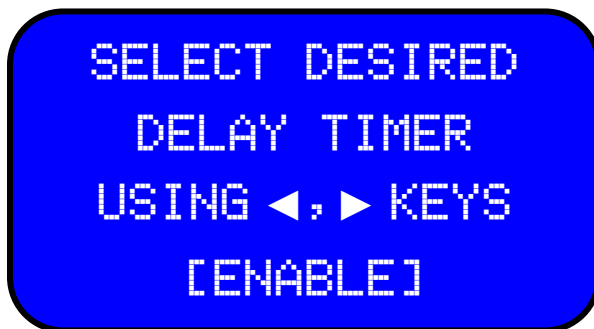
```
  SELECT DESIRED
   DELAY TIMER
  USING ◄,► KEYS
     [ENABLE]
```

A prompt will be shown to set this value as a default setting.

```
  WOULD YOU LIKE
    TO SAVE AS
     DEFAULT?
  <YES>    <NO>
```

6.7   Lock Settings

Lockout profile

Lock Setting → Unlock Profile

Change Password

```
   INTERFACES
   LCD SETTING
 ►LOCK SETTING
   TEDS DATA
```
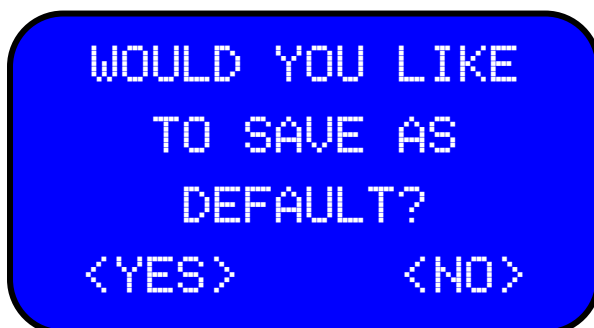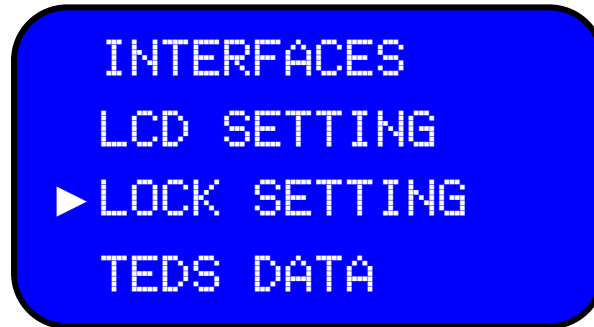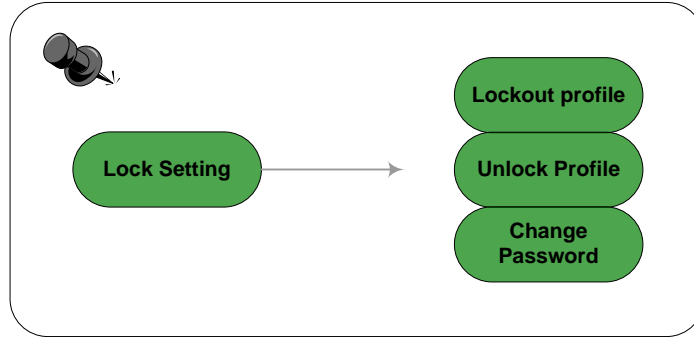
The Lock Setting menu is used to control access to the Sensor Profile settings and data information that have been stored in internal non-volatile memory (6.1.3.x and 6.1.4.x). Additionally, the Lock Setting menu is used to control the following submenus in Sensor Profile menu: New, Edit, Save, Delete.

6.7.1 Lockout Profile

Scroll to "**LOCKOUT PROFILE**" from "**LOCK SETTING**" using the ▲▼ keys and press **ENTER**. Once pressed **ENTER**, this feature will lockout the Edit, New, Save, and Delete of **SENSOR PROFILE** menu. However the Existing Channel(s) and the View Channel(s) options are still accessible.

```
▶LOCKOUT PROFILE

 UNLOCK PROFILE

 CHANGE PASSWORD

 --- --- --- --- --- --- --- --- ---
```
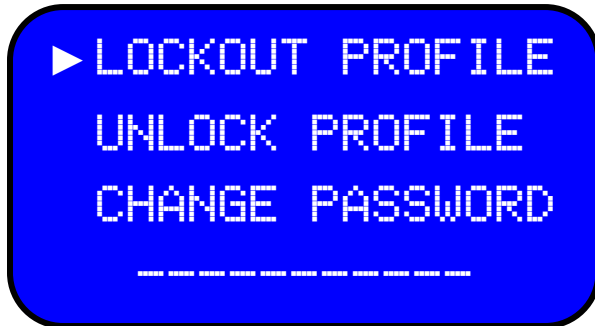
Enter the current password to lockout the sensor profile. If the correct password is entered the following success message will be displayed.

```
  ENTER CURRENT
     PASSWORD
 USING ARROW KEYS
    [0000000]
```

```
    OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 (HIT ENTER/BACK)
```

If the password is entered incorrectly, an invalid password message will appear:

```
 INVALID PASSWORD
 HAS BEEN ENTERED
 TRY AGAIN LATER!
 (HIT ENTER/BACK)
```
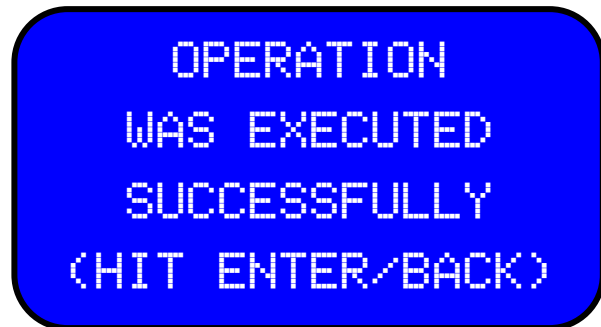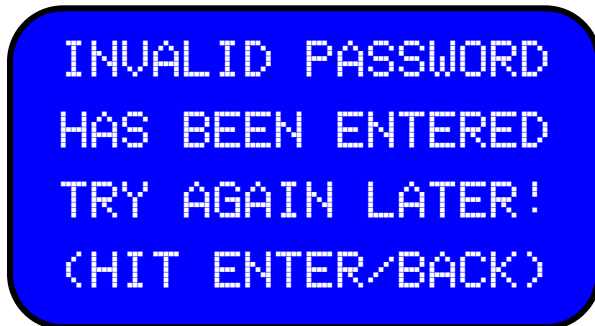
6.7.2   Unlock profile

Scroll to "UNLOCK PROFILE" from "LOCK SETTING" using the ▲ ▼ and press **ENTER**. Once pressed the **ENTER**, this feature unlocks the sensor profile menu and full access to sensor profile will be gained.

```
    LOCKOUT PROFILE
  ▶UNLOCK PROFILE
    CHANGE PASSWORD
    ___ ___ ___ ___ ___ ___ ___
```
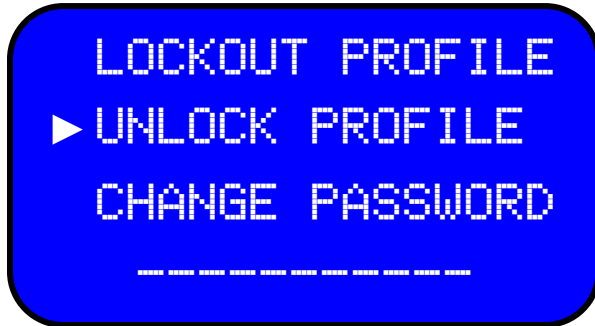
Enter the current password to unlock the sensor profile. If the correct password is entered, the following success message will be displayed.

```
    ENTER CURRENT
       PASSWORD
  USING ARROW KEYS
      [0000000]
```

```
       OPERATION
     WAS EXECUTED
     SUCCESSFULLY
   (HIT ENTER/BACK)
```

If the password is entered incorrectly, an invalid password message will appear:

```
  INVALID PASSWORD
  HAS BEEN ENTERED
  TRY AGAIN LATER!
  (HIT ENTER/BACK)
```

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- 109 -
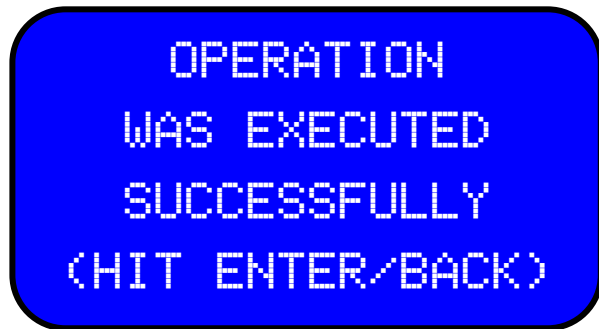
ISO 9001:2008   ISO 17025:2005   U.S. Manufacturer
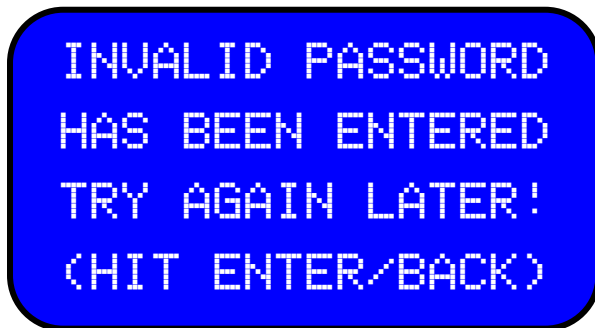
6.7.3 Change Password

Scroll to "CHANGE PASSWORD" from "LOCK SETTING" using the ▲▼ keys and press ENTER.

```
  LOCKOUT PROFILE
  UNLOCK PROFILE
 ▶CHANGE PASSWORD

  ---- ---- ---- ---- ---- ---- ---- ---- ----
```
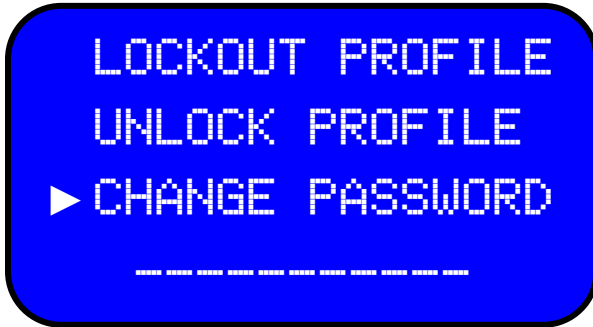
Use the ◀▶ and ▲▼ keys to select the current password.

```
  ENTER CURRENT
    PASSWORD
 USING ARROW KEYS
    [0000000]
```

The current password shall be entered in order to be able to change the password.
Once an incorrect password is entered, the following message will appear:

```
 INVALID PASSWORD
 HAS BEEN ENTERED
 TRY AGAIN LATER!
 (HIT ENTER/BACK)
```

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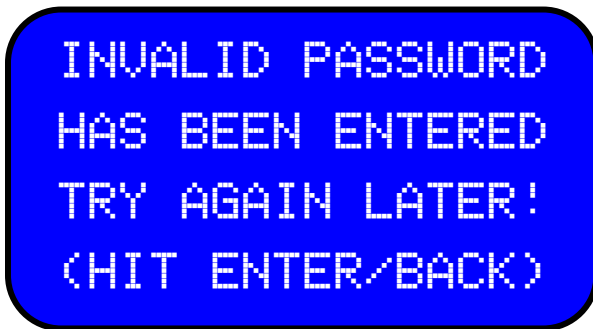
Use the ◄► and ▲▼ keys to set the desired password. Any combination of seven digits can be chosen. Press **ENTER** to save the new password.

```
   SELECT DESIRED
      PASSWORD
  USING ARROW KEYS
     [0000000]
```
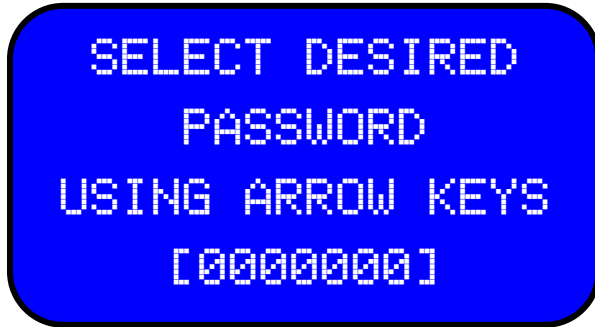
The following success message will appear on the screen once the desired password has been entered.

```
      OPERATION
    WAS EXECUTED
    SUCCESSFULLY
  <HIT ENTER/BACK>
```
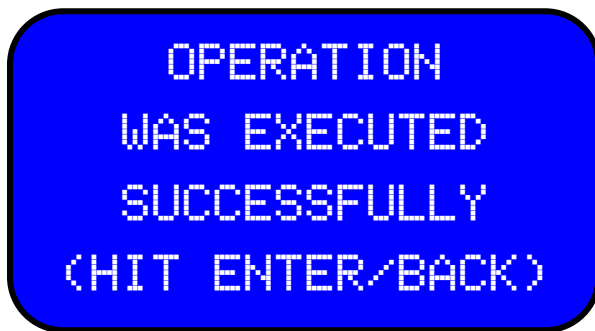
NOTE:
The IHH500 has a default password ([0000000]) mentioned in Appendix C. This password can be updated with desired password. Additionally there is an alternative permanent (please see Appendix C). In case the assigned password is forgotten, the alternative password can be used as the current password to lock/unlock /change the setting submenus.

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6.8   TEDS Data
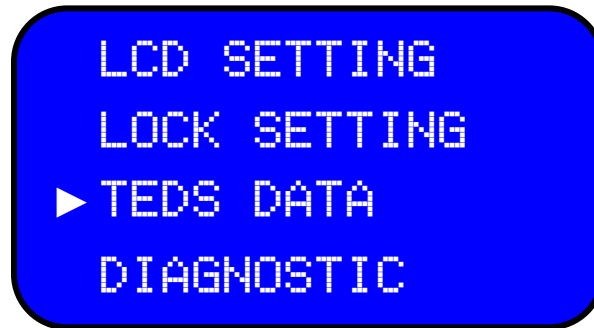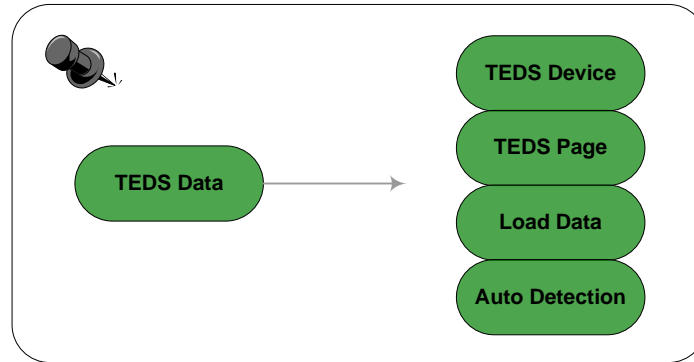
The mentioned IEEE 1451.4 standard defines a collection of templates for common class transducer. The templates provide the means for the measurement system to convert the binary data stored on a smart TEDS sensor EEPROM.

The IHH500 supports Template 30 for High level voltage output sensors and template 33 for bridge type sensors.
Transducers with stated template for different chip devices (DS2430, DS2431, DS2432 and DS2433) are supported with IHH500.

List of probable error while using TEDS:
Please see Appendix A

6.8.1   TEDS Device

Scroll to "**TEDS DEVICE**" from "**TEDS DATA**" using the ▲ ▼ keys and press **ENTER**.

```
►TEDS DEVICE
 TEDS PAGE
 LOAD DATA
 AUTO DETECTION
```

If a TEDS device is connected, the TEDS information will be displayed as shown below:

```
DEVICE:    DS2433
MEMORY:    4K BITS
TEDS SERIAL NO:
    000000D45CA1H
```
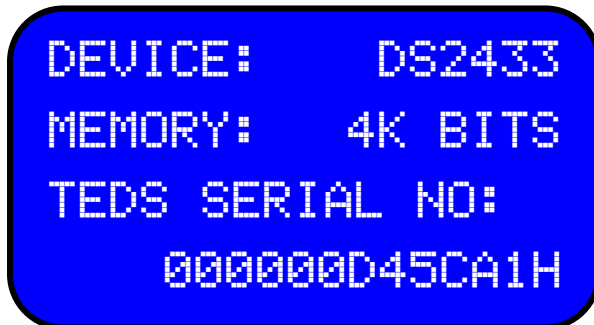
If the **TEDS DEVICE** is selected without a connected TEDS device, an error message will be displayed.

```
 TEDS ERROR #00
  TEDS DEVICE
WAS NOT DETECTED
(HIT ENTER/BACK)
```

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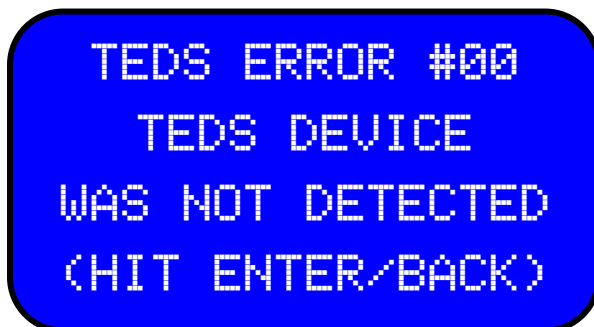
6.8.2 TEDS Page

Scroll "TEDS PAGE" from "TEDS DATA" using THE▲ ▼ keys and press ENTER.
A total of sixteen pages (0 – 15) can be selected

```
     TEDS DEVICE
  ▶ TEDS PAGE
     LOAD DATA
     AUTO DETECTION
```

```
   03E8042000003753
   0000000000148400
   8000000002412000
   2316C0DA28EC8F5C
```
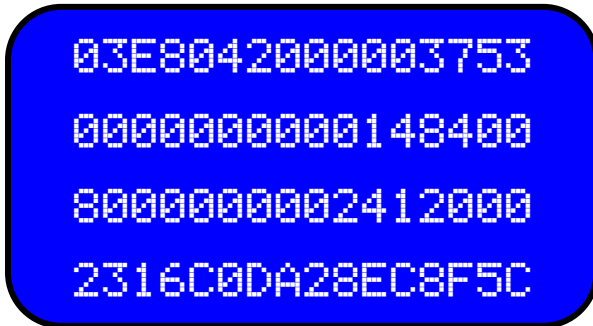
If TEDS PAGE is selected, without a connected TEDS device, an error message will be displayed.

Each TEDS page is 32 bytes and is mapped as below:

00H	→	07H
08H	→	0FH
10H	→	17H
18H	→	1FH

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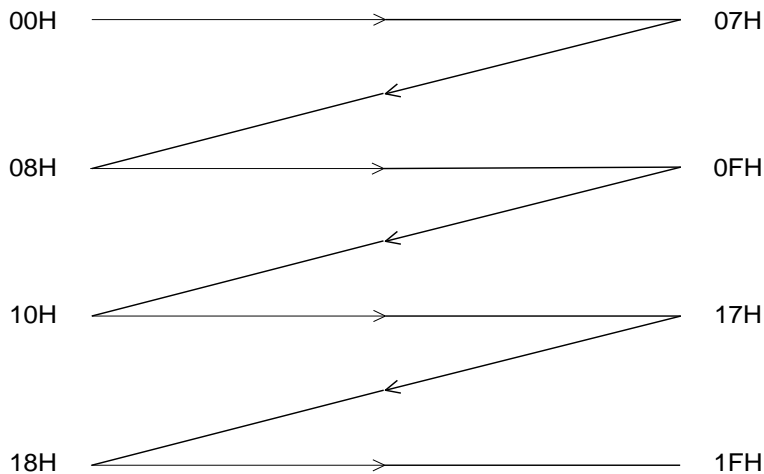
6.8.3   Load Data

Scroll to "**LOAD DATA**" from "**TEDS DATA**" using the▲▼ keys and press **ENTER**.

```
   TEDS DEVICE
   TEDS PAGE
 ▶LOAD DATA
   AUTO DETECTION
```

The load data option loads the new profile, based on the TEDS data, and performs an auto calibration.

```
  LOADING PROFILE
    IN PROGRESS
  PLEASE WAIT  30
```

```
  AUTO CALIBRATION
    IN PROGRESS
  PLEASE WAIT   15
      .........
```

```
TEMPLATE       33
SERIAL       1000
+10.0000      lbs
+2.50000     mV/V
```
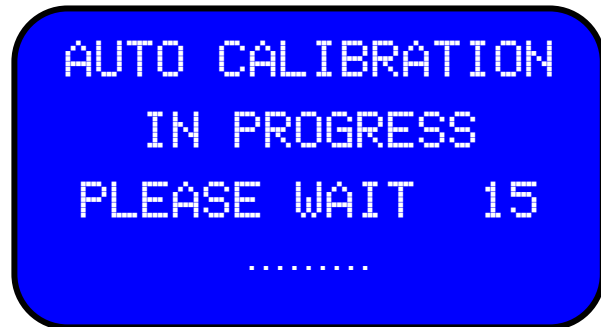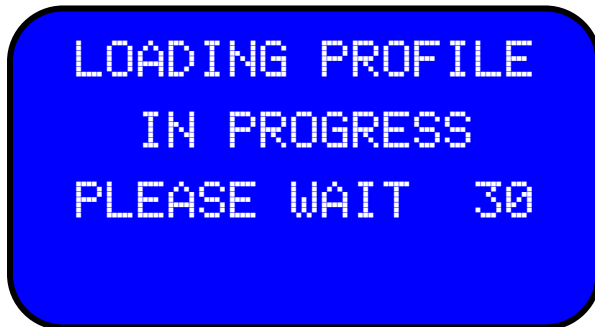
If **Load Data** is selected, without a connected TEDS device, an error message will be displayed.

6.8.4 Auto Detection

Scroll to "**AUTO DETECTION**" from "**TEDS DATA**" using the▲▼ keys and press **ENTER**.

If "**AUTO DETECTION**" is enabled, the IHH500 will search for a TEDS device during power up. If TEDS information exists, its information will be loaded; otherwise the IHH500 will load the active channel.
If "**AUTO DETECTION**" is disabled, the IHH500 will load the active channel during power up.

```
  TEDS PAGE
  LOAD DATA
 ▶AUTO DETECTION
  _____
```

Use the ◀▶ keys to Enable or Disable the TEDS Auto Detection feature

```
 SELECT DESIRED
    ACTIVITY
 USING ◀,▶ KEYS
    [ENABLE]
```
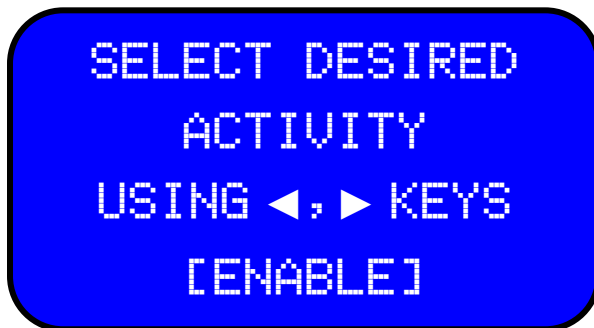
The following message will be displayed confirming the operation was executed successfully.

```
   OPERATION
  WAS EXECUTED
  SUCCESSFULLY
 <HIT ENTER/BACK>
```

6.9 Diagnostic

Diagnostic
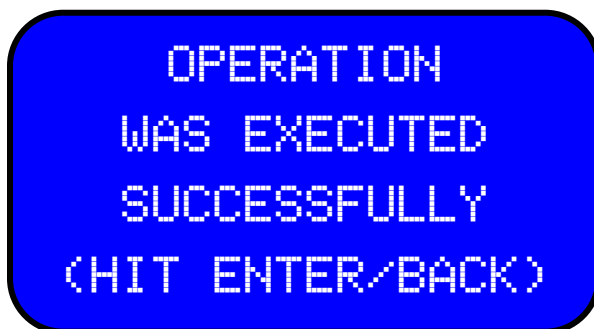
```
  LCD SETTING
  TEDS DATA
▶ DIAGNOSTIC

  ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
```
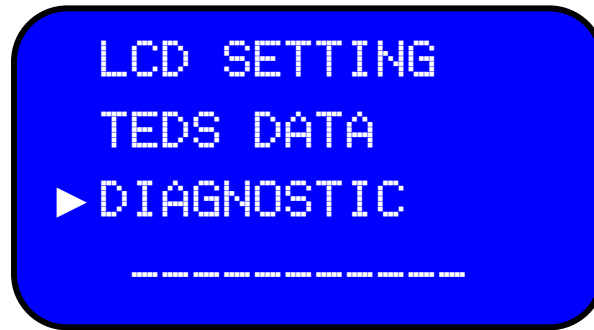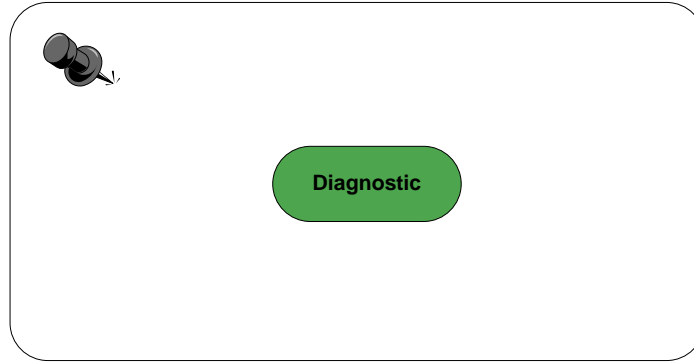
6.9.1   Internal or External

Scroll to "DIAGNOSTIC" using the ▲ ▼keys and press **ENTER**.
 Use the ◄► keys to select either INTERNAL or EXTERNAL diagnostic.

```
SELECT DESIRED
   DIAGNOSTIC
USING ◄,► KEYS
   [INTERNAL]
```

```
AVDD1 :    4.999V
AVDD2 :    5.200V
DVDD  :    5.001V
VBAT  :    8.500V
```
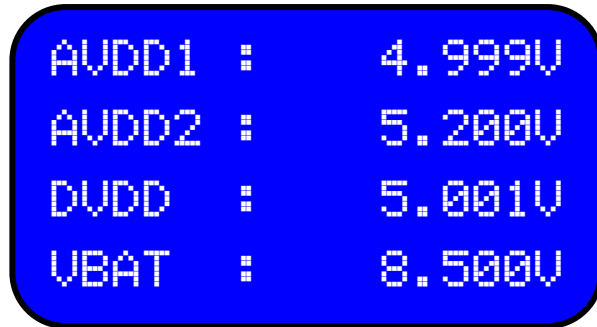
The internal diagnostic shows the analog VDD1, analog VDD2, digital VDD, and VBAT values.

```
SELECT DESIRED
   DIAGNOSTIC
USING ◄,► KEYS
   [EXTERNAL]
```

```
TEMP(˙C):   +28˙C
TEMP(˙F):   +82˙F
BRIDGE  :   350Ω
+2.34567    mV/V
```
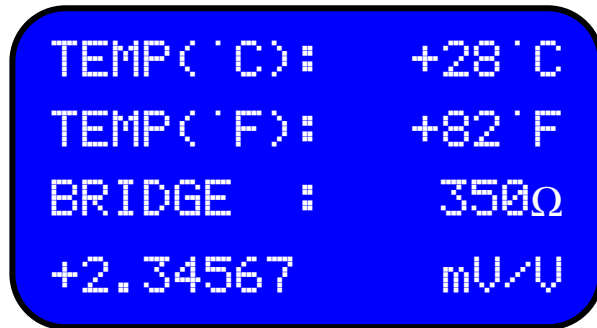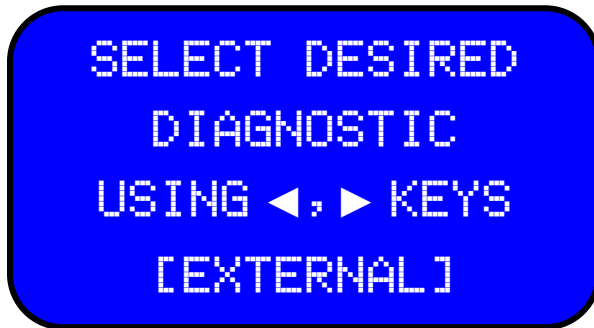
The external diagnostic shows the sensor sensitivity, Temp, and bridge resistance.

NOTE:
The external diagnostic page can only show the information of a Strain gage with the sensitivity of less than 4mV/V. If the sensor is amplified voltage output or current output or has a sensitivity more than 4 mV/V, when trying to display External Diagnostic, an error message will appear stating that this function is not available.

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7 Appendix A (List of Probable Errors)

Error No.	Error Description on the LCD
Error #1	TEDS DEVICE WAS NOT DETECTED
Error #2	UNKNOWN DEVICE WAS DETECTED
Error #3	UNKNOWN TEMPLATE WAS DETECTED
Error #4	UNKNOWN UNIT WAS DETECTED
Error #5	ELECTRICAL VALUE IS INVALID
Error #6	TEDS DATA IS INVALID
Error #7	BRIDGE TYPE IS INVALID

Error #1: TEDS DEVICE WAS NOT DETECTED
If any non TEDS sensor is connected or if TEDS is not connected properly the mentioned error will occur.

Error #2: UNKNOWN DEVICE WAS DETECTED
The IHH500 supports chip number DS2430, DS2431, DS2432 and DS2433. Any other TEDS device with a different data sheet numbers will not be able to interact with the IHH500.

Error #3: UNKNOWN TEMPLATE WAS DETECTED
The IHH500 supports template numbers 30 and 33; any other TEDS device with different template numbers will not be able to interact information with the IHH500.

Error #4: UNKNOWN UNIT WAS DETECTED
If the sensor's TEDS has been defined with units other than IEEE standard units, the mentioned error will occur.

Error #5: ELECTRICAL VALUE IS INVALID
This error occurs when the electrical values are more than defined values.

Error #6: TEDS DATA IS INVALID
The defined TEDS information is invalid.

Error #7: BRIDGE TYPE IS INVALID
The IHH 500 supports full bridge only configurations, therefore any other bridge type transducers like quarter or half plugged to this device will not recognized and the mentioned error to occur.

8   Appendix B (List of Messages)

Message No.	Message Description on the LCD	Pages
Welcome Message	FUTEK ADVANCED SENSOR TECH INC. IHH500-ELITE MADE IN USA	15
Delete Message	WARNING! SELECTED PROFILE MAY BE LOST! ACCEPT CANCEL	61
Delete Confirmation	ARE YOU SURE WANT TO DELETE ACTIVE CHANNEL? YES NO	61
Interface Warning	WARNING! EXISTING SETTING MAY BE CHANGED ACCEPT CANCEL	92,93,94,95,96
Unsaved Data Warning	WARNING! EXIT WITHOUT SAVING PROFILE? YES NO	29
Success Message	OPERATION WAS EXECUTED SUCCESSFULLY HIT ENTER / BACK	30,31,33,34,35,36,37,38,39, 41,42,43 ,44,47,49,52,54,60,63, 103,104,106,108,110
Confirmation Message	WOULD YOU LIKE TO SAVE AS DEFAULT? YES NO	65,66,67,70,71,73,75,79,80,81,82,83,84 87,88,89,90,91,92,99,100,101
Edit/ delete Warning	THERE IS NOT ANY CHANNEL AVAILABLE FOR THIS INTENTION	54,60
(+)No Load Calibration	APPLY ZERO LOAD (+) CALIBRATION THEN PRESS ENTER	40

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(+)Full Load Calibration	APPLY FULL SCALE (+) CALIBRATION THEN PRESS ENTER	41
(-)Full Load Calibration	APPLY FULL SCALE (-) CALIBRATION THEN PRESS ENTER	41
(-)No Load Calibration	APPLY ZERO LOAD (-) CALIBRATION THEN PRESS ENTER	41
Unavailable Feature	SELECTED FEATURE IS NOT AVAILABLE AT THIS TIME HIT ENTER / BACK	28,54,58,62
Battery full	BATTERY FULL! YOU CAN UNPLUG BATTERY CHARGER FROM THE DEVICE	18
Battery low	BATTERY LOW! CONNECT THE BATTERY CHARGER TO THE DEVICE	18
Incorrect password Warning	INVALID PASSWORD HAS BEEN ENTERED TRY AGAIN LATER! (HIT ENTER/ BACK)	102,103,104
Data Logging Confirmation	DATA LOGGING PROGRESS COMPLETED SUCCESSFULLY	75,76

9 Appendix C (Device Specifications)

Main Control Processor Unit (MCPU)

Part #:   MSC1214 (Elite Version)
Internal ADC Resolution: 24 bits
Sampling Rate: 60 SPS
Application: Diagnostic mode

DAC Resolution: *   16 bits
DAC Accuracy: *   0.02% of FSR (Factory Calibrated)
DAC Non linearity:*   0.1% of FSR (Factory Calibrated)
Application:*   Voltage output/ Current output

Analog to Digital Converter (ADC)

Part #:   AD7190
Recommended Load: 30 to 30000 Ω
Bridge Excitation: 5.000 V ± 1 mV (limited current to 160 mA)
Input Range: ±2.5 V (0-500mV/V)   Channel 1 for bridge
Input Range: ±12 V   Channel 2 for Voltage/Current input
Sampling rate: up to 4800 SPS
Non linearity: ± 5 PPM for FSR
Offset Drift vs. temperature: ± 5 PPM/°C
Span Drift vs. temperature: ± 5 PPM/°C
Application: Signal measurement

Voltage Reference

Part #:   MAX6126AASA25+
Accuracy: ± 0.02%
Nominal Voltage: 2.5 V
Temperature Shift: ± 3 PPM/°C
Application: Reference Voltage / Excitation voltage

Power Requirement

Internal battery: Rechargeable, lithium polymer battery
Battery size: 7.4 V/ 3000 mAh
Run Time: up to 30 hours with 350Ω Bridge
Battery Charger: Wall plug AC powered-unit
Battery Charger Output: 12 V/ 1 A
Battery Indicator: 0-100%, 0-8.5 V
Battery Warning: Less than 20%
Run Time: Up to 30 hours (350 Ω Bridge connected)

Solid State Relays *

Part #:	G3VM-2F
Application:	Alarm relay 1, 2
Maximum Output Voltage:	250 V (AC or DC)
Maximum Output Current:	120mA

Note: Internally limited and protected to 110 V/100 mA

*Available in Elite Version Only

Liquid Crystal Display (LCD)

Part #:	CFAH1604B-TMI-ET
Brand:	Crystalfontz America, Inc.
Number of Characters (Width):	16 Characters
No. of Lines (Lines):	4 Lines
Backlight Type & Color:	T-LED, white
Fluid Type, Image (Positive or Negative), & LCD glass Color:	M-STN, Negative, blue
Polarizer Film Type, Wide (WT) Temperature Range, & Viewing Angle (O'clock):	I-Transmissive, WT, 6:00
Character Set (CGROM):	English and European fonts
Controller:	T-Sitronix ST7066U

Mounting detail

2 pin male connector:	99 5101 00 02	IP66
2 pin Female connector:	09 0104 99 02	IP66
4 pin male connector:	99 5109 00 04	IP66
4 pin Female connector:	09 0112 99 04	IP66
8 pin male connector:	99 5171 00 08	IP66
8 pin Female connector:	09 0174 99 08	IP66
12 pin male connector:	99 5129 00 12	IP66
12 pin Female connector:	09 0132 90 12	IP66

Power Output *

Part#:	DCP020515DU, LM2671
Nominal Output1:	24 V / 50 mA
Nominal Output2:	5 V / 50 mA
Application:	Excitation for amplified sensors

Response Times

Conversion capture rate:	every sample

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Peak capture rate: every sample
Valley capture rate: every sample
Conversion display update rate: 5 times per second
Peak display update rate: 5 times per second
Valley display update rate: 5 times per second

Bandwidth
The digital output bandwidth has been specified as **SPS/4**.
The analog output bandwidth has been specified as **SPS/4** for sampling rates **less than 1200 SPS** and has been specified as **SPS/5** for sampling rates **more than 1200 SPS** if:
 a. ASCII stream output is deactivated,
 b. IHH500 is not connected to computer,
 c. All relays are disabled
 d. Display is in menu mode (Peak, Valley, Tracking and data display are main display mode).

Default Password: **0000000**
Alternative Password: **Device's Serial Number**

Instrument Weight: 1.85 lbs. (840 g) without mounting bracket
Dimensions: *4" (W) x 6" (L) x 1.65" (D)*

10 Appendix D TEDS IEEE 1451.4 Introduction

10.1 What is TEDS?

Plug and play sensor hardware and software makes configuring a smart TEDS sensor as easy as plugging a mouse into a PC. Efficiency and productivity has greatly improved due to the elimination of manual sensor configuration.

10.2 Basic Concept

TEDS is at the heart of the new universally accepted IEEE1451.4 standard for delivering plug and play capabilities to analog measurements and test instruments. In essence, information in a Transducer Electronic Data Sheet, (TEDS), provides instruments with critical sensor calibration information allowing for accurate and precise measurements every time.

- TEDS works in a similar way in which USB computer peripherals immediately work when a USB device is connected.

- TEDS enabled equipment may be swapped out without a recalibration, saving time and money.

- TEDS holds information such as sensor manufacturer, model and serial numbers, and more importantly, all of the calibration settings determined by the manufacturer.

10.3 How it works

Plug and play is a data acquisition technology that can simplify the configuration of automated measuring systems by making a sensor's unique identification data available electronically. As implemented according to IEEE P1451.4, data in the form of a transducer electronic data sheet (TEDS) is burned on an electrically erasable programmable read only memory (EEPROM) chip located on the sensor, so when a properly adapted signal conditioner interrogates the sensor, it can interpret the self identification data. This technology provides a great benefit by eliminating the need for a traditional paper calibration sheets. In addition, it can simplify labeling and cabling problems, as well as inventory control; by letting you burn the location data onto the chip when installing a sensor. Finally, because all sensors that are produced according to the standard will carry the same basic identically formatted self-identification information, you will be able to use the sensors and applicable signal conditioners interchangeably across manufacturers.

11 Appendix E (System Performance)

Specifications:

Parameter	ADC	Unit
Output Data Rate	5 to 4800	Hz nom
No Missing Codes	24	Bits min
Resolution	See the following RMS Noise and Resolution Table	
RMS Noise and Output Data Rates	See the following RMS Noise and Resolution Table	
Integral Nonlinearity	±5 (Current or Voltage Input) ±15 (Bridge Input)	ppm of FSR max ppm of FSR max
Offset Error	±0.58	µV/ typ
Offset Error Drift vs. Temperature	±0.78	nV/°C typ
Offset Error drift vs. Time	25	nV/1000 hours typ
Gain Error	±0.005 (Current or Voltage Input) ±0.0075 (Bridge input)	% max %typ
Gain Drift vs. Temperature	±1	ppm/°C typ
Gain Drift vs. Time	10 (Current or Voltage Input)	ppm/1000 hours typ
Power Supply Rejection	95 (Current or Voltage Input) 100 (Bridge input)	dB typ dB min
Common Mode rejection @ DC @50Hz, 60Hz @50Hz, 60Hz	100 (Current or Voltage Input) 110 (Bridge input) 120 120	dB min dB min dB min dB min
Normal Mode Rejection	120 (10 Hz output data rate) 82 (50 Hz output data rate)	dB min dB min
Normal Mode Rejection Common Mode Rejection Reference Detect Levels	Same as for analog inputs 95 0.3 0.6	dB typ V min V max

RMS Noise (µV):

Output data Rate (Hz)	Settling Time (ms)	S≤500mV/V*	S≤7.5mV/V	S≤3.5mV/V
5	818	0.256	0.640	1.152
10	400	0.330	0.896	1.472
25	160	0.544	1.344	2.304
30	133.4	0.615	1.472	2.560
50	80	0.900	2.112	3.584
60	66.7	0.970	2.304	3.968
100	40	1.161	2.816	4.864
200	20	1.567	3.968	6.900
400	10	2.067	5.440	9.600
600	6.66	2.400	6.656	11.648
800	5	2.734	7.936	13.824
960	4.17	3.000	8.960	15.488
1200	3.33	3.334	9.856	17.152
1600	2.5	3.8889	11.264	19.8826
2400	1.67	5.000	14.080	25.344
4800	0.83	14.300	24.320	337.760

* The same specification will be applied to current and voltage input channel.

Effective Resolution (peak to Peak Resolution):

Output data Rate (Hz)	Settling Time (ms)	S≤500mV/V**	S≤7.5mV/V	S≤3.5mV/V
5	800	23 (21.5)	23 (20)	22 (19.5)
10	400	23 (21)	22.5 (19.5)	21.5 (19)
25	160	22 (19)	22 (19)	21 (18)
30	133.3	23 (20.5)	22 (19)	21 (18)
50	80	22.5 (19.5)	21 (18.5)	20.5 (17.5)
60	66.7	22.5 (19.5)	21 (18.5)	20.5 (17.5)
100	40	23 (19.5)	21 (19)	21 (17.5)
200	20	21.5 (19)	20 (17.5)	19 (17)
400	10	21 (18.5)	20 (17)	19 (16)
600	6.7	21 (18)	19.5 (17)	19 (16)
800	5	21 (18)	19.5 (17)	18.5 (16)
960	4.17	20.5 (19)	20 (17.5)	18.5 (15.5)
1200	3.33	20.5 (18)	19 (16)	18 (15.5)
1600	2.5	20 (17.5)	18.5 (15.5)	18 (15)
2400	1.67	20 (17)	18.5 (15.5)	17.5 (15)
4800	0.83	18.5 (15.5)	17.5 (15)	17 (14.5)

** The same specification will be applied to current and voltage input channel.

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