N1500G

UNIVERSAL INDICATOR - OPERATING MANUAL

1. PRESENTATION

N1500G is a universal process indicator which accepts a large variety of input signals and sensors.

A five-digit LED display shows measured value and all programming parameters.

Instrument configuration is achieved from the keyboard, without any hardware change.

The user should read this manual thoroughly before using the instrument. It is a fine electronic device and should be used accordingly for best results.

Some of the features of the basic version are:

- Universal input: Pt100, thermocouples, 4-20 mA, 0-50 mV and 0-5 Vdc
- 24Vdc power supply for remote transmitters excitation
- **Maximum** and **minimum** memory
- Digital input with **Hold Peak Tare** and **hold** function
- Process Variable retransmission in 0-20 mA or 4-20 mA
- RS485 MODBUS RTU serial communication

Display: Shows process variable (PV) and the programming prompts.

ALM1 and ALM2: show alarm status.

[INDEX]	**INDEX key** - This key is used to access the programming menu and prompts.
[BACK]	**BACK key** - This key is used to go back to the previously reached prompt in the menu cycle.
[MAX]	**UP / MAX** key and [MIN] **DOWN / MIN** - Used to increase and decrease parameters values, these keys are also used to display maximum and minimum values stored in memory..
[F]	**Special FUNCTION key** - This special function key is used for pre-programmed functions as explained in the SPECIAL FUNCTION KEY section of this manual.

2. PROCESS VARIABLE INPUT - PV

The Process Variable input type should be keyboard programmed by the user according to the codes shown on table 1 (refer to INPUT TYPE parameter " **IntYP**").

All input types are factory calibrated and no additional calibration is required.

Thermocouples are calibrated to NBS standards. RTD's are calibrated to DIN 43760 (α=0.00385).

TIPO	CODE	CARACTERÍSTICAS
J	tc J	Range: -50 to 760 °C (-58 to 1400 °F)
K	tc P	Range: -90 to 1370 °C (-130 to 2498 °F)
T	tc t	Range: -100 to 400 °C (-148 to 752 °F)
E	tc E	Range: -35 to 720 °C (-31 to 1328 °F)
N	tc n	Range: -90 to 1300 °C (-130 to 2372 °F)
R	tc r	Range: 0 to 1760 °C (-32 to 3200 °F)
S	tc S	Range: 0 to 1760 °C (-32 to 3200 °F)
B	tc b	Range: 150 to 1820 °C (302 to 3308 °F)
Pt100	Pt 100	Range: -199.9 to 530.0 °C (-327.8 to 986.0 °F)
Pt100	Pt 100	Range: -200 to 530 °C (-328 to 986 °F)

4-20 mA	Lin J	Linearizes J. Adjustable range: -110 to 760 °C
4-20 mA	Lin P	Linearizes K. Adjustable range.: -150 to 1370 °C
4-20 mA	Lin t	Linearizes T. Adjustable range.: -160 to 400 °C
4-20 mA	Lin E	Linearizes E. Adjustable range.: -90 to 720 °C
4-20 mA	Lin n	Linearizes N. Adjustable range -150 to 1300 °C
4-20 mA	Lin r	Linearizes R. Adjustable range 0 to 1760 °C
4-20 mA	Lin S	Linearizes S. Adjustable range.: 0 to 1760 °C
4-20 mA	Lin b	Linearizes B. Adjustable range.: 100 to 1820 °C
4-20 mA	LinPt	Linearizes Pt100. Adj. range.:-200.0 to 530.0 °C
4-20 mA	LinPt	Linearizes Pt100. Adj. range.: -200 to 530 °C
0-50 mV	0-50	Linear. Adjustable range.: -1999 to 9999
4-20 mA	4-20	Linear. Adjustable range.: -1999 to 9999
0 a 5 V	0- 10	Linear. Adjustable range.: -1999 to 9999

Table 1 - Input type codes

3. ALARMS

The indicator features 2 alarm outputs in the basic version. Each alarm has a corresponding LED anunciator in the front panel to show alarm status.

TYPE	PROMPT	ACTION
Disabled	oFF	Alarm is inactive
Sensor Break (input **Error**)	IErr	Alarm will go ON if sensor breaks, input signal is out of range or Pt100 is shorted.
Low Alarm	Lo	Alarm SP → PV
High Alarm	HI	Alarm SP → PV
Diferential Low	dIF.Lo	AL SP / AL SP + Deviation → PV
Diferential High	dIF.HI	AL SP / AL SP + Deviation → PV
Diferential	dIF	Positive Deviation / AL SP - Deviation / AL SP / AL SP + Deviation → PV; Negative Deviation / AL SP + Deviat. / AL SP / AL SP - Deviation → PV

Table 2 - Alarm functions

3.1. ALARM FUNCTIONS

The alarms can set to operate in six different functions: Sensor break, Low Alarm, High Alarm, Differential Low, Differential High or Differential (Band). These functions are shown in table 2 and described as follows

3.1.1. Sensor break
The alarm will go ON whenever the sensor breaks or is badly connected.

3.1.2. Low alarm
The alarm relay will go ON whenever the measured value is below the alarm set point.

3.1.3. High alarm

The alarm relay will be ON whenever the measured value is **above** the alarm set point.

3.1.4. Differential (Band)

For differential alarm 2 parameters must be set: Differential **Al**arm **Ref**erence value (ALrEF) or alarm setpoint and Alarm Deviation (Band).

For a positive deviation the alarm will switch on whenever the measured value is **out** of the band defined as:

(ALrEF - Deviation) and (ALrEF + Deviation)

For a negative deviation the alarm will be switched on whenever the measured value is **within** the band defined above.

3.1.5. Differential Low

The alarm relay will be ON whenever the measured value is **below** the band defined as:

(ALrEF - Deviation)

3.1.6. Differential High

Alarm relay will be ON when the measured value is **above** the band defined as:

(ALrEF + Deviation)

3.2. ALARM INITIAL BLOCKING

The initial blocking option inhibits the alarm from being recognized if an alarm condition is present when the controller is first energized. The alarm will actuate only after the occurrence of a non alarm condition followed by a new occurrence for the alarm.

The initial blocking is disabled for the **sensor break** alarm function.

3.3. ALARM TIMER

The alarms can be programmed to have timer functions where the user can set a delayed alarm action, just one pulse in an alarm event, or an oscillator function with sequential pulses.

Table 3 shows these advanced functions. Times T1 and T2 can be programmed from 0 to 6500 seconds (refer to item 8.2). Set 0 (zero) at the T1 and T2 prompt for a normal non-timer alarm operation.

The LEDs alarm anunciators will go ON whenever there is an alarm condition regardless of the present alarm status which may be temporarily off because of timer action.
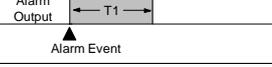
Advanced Function	T1	T2	ACTION
Normal Operation	0	0	Alarm Output — Alarm Event
Delayed	0	1s to 6500s	Alarm Output ← T2 → — Alarm Event
Pulse	1s to 6500s	0	Alarm Output ← T1 → — Alarm Event
Oscillator	1s to 6500s	1s to 6500s	Alarm Output ← T1 → ← T2 → ← T1 → — Alarm Event

Table 3 - Timer Alarm Functions

4. SPECIAL FUNCTIONS

4.1. MAXIMUM AND MINIMUM

The indicator memorizes the measured maximum and minimum values (peak and valley). These two values are shown by pressing either the **MAX** or **MIN** key. Pressing both keys simultaneously will clear the memory for a new peak and valley detection.

4.2. SPECIAL FUNCTION KEY AND DIGITAL INPUT

The **F** key and the optional digital input can execute special functions according to the user selection.

These functions can be chosen independently to the **F** key or to the digital input. Figure 10 shows how to activate the digital input. A closed contact or a short circuit at terminals 8 and 9 is recognized as activating the digital input.

The special functions for the **F** key and for the digital input are explained as follows.

4.2.1. Hold

The **hold** function freezes the measured value in the display. Each touch at the **F** key or closing the digital input alternates from **hold** to normal mode.

Whenever the indicator is in the **hold** mode a "HoLd" message is briefly displayed to show the operator that the displayed value is the frozen value and not the present reading.

4.2.2. Peak Hold

The indicator turns automatically to **Peak Hold** mode whenever the **F** key or the digital input are programmed for "PHoLd"

This operation mode makes the indicator display only the maximum reading value from the time the key was pressed of the digital input was activated.

Each activation of the **F** key or digital input triggers a new **Peak Hold** cycle and the display resets with a new peak value.

4.2.3. Reset (clears maximum and minimum)

This function works the same way as the MAX and MIN keys pressed simultaneously, as explained in the 5.1 section.

If this "rESEt" function is programmed, for every touch of the **F** key or activation of the digital input the memory will be cleared and a new cycle of maximum and minimum will start.

4.2.4. AL.oFF - Alarm blocking

This function allows the user to block or inhibit the alarm relays by pressing the F key or by activating the digital input. Each touch of the key or activation of the digital input will alternate the function from ON to OFF and vice-versa.

If an alarm situation occurs, the respective alarm status LEDs in the front panel will light regardless of the relay alarm blocking status.

4.2.5. Tare

This function is used to zero the display. The tare residual values is subtracted or added to the total measured value. This function is generally used with load cells and strain gauges and applies to linear 4-20 mA, 0-50 mV and 0-5 V inputs.

4.3. PROCESS VARIABLE RETRANSMISSION

As an option, the indicator can be supplied with an isolated 0-20 mA or 4-20 mA analog output for Process Variable (PV) retransmission.

The PV values which define the range of the 0-20 mA or 4-20 mA retransmission can be programmed by the user in the **high and low indication limits**.

When available, this current output will be always active.

For a voltage output signal an external shunt (calibrated resistor) should be installed at the analog output terminals.

5. INSTALLATION

5.1. PANEL ASSEMBLY

The indicator is composed of two parts: the fixing base and the front part with main circuits. The base must be removed from the front and fixed onto a wall by means of four designed holes as shown in figure 2.
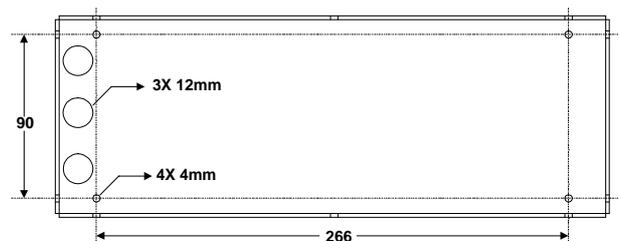

Figure 2 - Mounting the indicator in the panel cut-out.

The front part is only attached to the fixing base after all electrical wire connections are done.

5.2. ELECTRICAL CONNECTIONS

The internal electronics can be removed from the front panel without any cable disassembly. The input signals and power connections are shown in Figure 3.
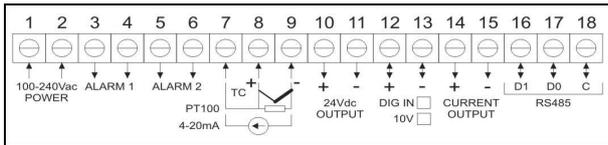

Figure 3 - Back panel terminals

5.2.1. Recommendations for Installation

- Input signal wires should be laid out away from power lines and preferably inside grounded conduits.
- Instrument mains should be suitable for this purpose and wires should not be shared with high consumption motors and inductors.
- RC filters (47Ω and 100nF) are highly recommended for valve and contactor coils, etc.

5.2.2. Sensor or input signal connection

These connections should be properly done and terminals must be well tightened. Thermocouples must be installed with proper extension or compensation cables.

Pt100 RTDs must be 3-wire connected and the wires connected should have the same electrical resistance (same wire gauge) for correct cable length compensation. Four-wire RTDs can be connected by disconnecting the fourth wire. Two-wire RTDs can be connected by shortening terminals 7 and 8 and connecting the Pt100 to terminals 8 and 9.

6. OPERATION

For best results this indicator requires correct setting of parameters as input type (T/C, Pt100, 4-20 mA, etc), alarms actuation point, alarm function, etc.

These parameters are divided in five levels or groups of parameters which we will refer to as CYCLES.

Cycle	Access
1- Work	free access
2- Alarms	
3- Functions	
4- Configuration	reserved access
5- Calibration	

Table 4 - Parameters Cycles

The work cycle has free access. All other cycles require a certain combination of key strokes to be accessed. The combination is:

⏎ and BACK keys pressed simultaneously

Within a certain cycle just press ⏎ to go to the following parameters. At the end of each cycle the display will go back to the work cycle.

At the desired prompt just press the **MAX** or **MIN** key to change this parameter accordingly.

All changes are recorded in non-volatile memory as we move to next prompt. After 25 seconds with no key pressed the indicator will return to the measuring cycle (work cycle).

6.1. CYCLE PROTECTION

The values of parameters of a certain cycle can be protected against non-authorized users.

The protected parameters can still be viewed but can not be changed.

To protect a cycle just press the **BACK** and **MAX** keys for 3 seconds at the beginning of the referred cycle. To unlock this cycle just press the same keys again for 3 seconds.

The display will briefly blink confirming that the locking or unlocking of the cycle.

7. PROGRAMMING THE INDICATOR

7.1. WORK CYCLE

This is the first and main cycle. At power up the indicator will display the Process Variable (PV). The alarm setpoints are also displayed at this cycle. To run through this cycle just press the ⏎ key.

Whenever an alarm is set with differential function the respective alarm setpoint is blocked (SP.AL1, SP.AL2, ...) and the display shows "**diF**" to advise the operator that this is a configuration parameter and that the respective deviation value must be programmed at the Alarms Cycle. The "**AL.rEF**" prompt will be displayed showing the reference value for the alarm with differential function.

TELA	PARAMETER DESCRIPTION
8.8.8.8.8.	**Measure** Shows the measured variable. For Pt100 or thermocouples the display will show the absolute temperature value. For 4-20 mA, 0-50 mV and 0-5 V inputs the display shows the values defined in the **in.LoL**" and "**in.HiL**" prompts. With the **hold** function programmed the display shows the frozen variable and alternates with the message "**HoLd**". Likewise, with *Peak Hold* function programmed the high limit is displayed with the "**P.HoLd**" prompt alternately. Should any fault situation occur the indicator will display an error message which can be identified at item 11 of this manual.
AL.rEF	**Differential Alarm Reference Value** - This prompt is shown only when there is an alarm programmed with differential function.
SP.AL1 SP.AL2 SP.AL3 SP.AL4	**Set Points of Alarms 1, 2, 3 and 4** - Defines the operation point of each alarm programmed with "**Lo**" or "**Hi**" function. Note: When the alarms are programmed with differential function, the alarm setpoint cannot be changed at this cycle and a "**diF**" message will be shown. The SP differential (deviation) value is set at the Alarm Cycle.

7.2. ALARM CYCLE

Fu.AL1 Fu.AL2 Fu.AL3 Fu.AL4	**Alarm Function** - Defines the alarms 1, 2, 3 and 4 function, as defined in item 4.1 **oFF** : Alarm off **iErr** : Broken or Shorted Sensor **Lo** : Low value **Hi** : High value **DiFL** : Differential low **DiFH** : Differential high **DiF** : Differential
dF.AL1 dF.AL2 dF.AL3 dF.AL4	**Differential SP for Alarms 1, 2, 3 and 4** - Defines the deviation value from the alarm setpoint in relation to the Reference Value defined in the "**ALdiF**" prompt. Note: This value cannot be changed at this cycle for alarms with non-differential function and the "**AbS**" is then displayed.
HY.AL1 HY.AL2 HY.AL3 HY.AL4	**Alarm Hysteresis** This is the difference from the measured value to the point where the alarm is turned ON and OFF.
bL.AL1 bL.AL2 bL.AL3 bL.AL4	**Alarm Blocking** Should any alarm condition occur, each alarm can be disabled when energizing the indicator. Refer to item 4.3.

AL I t 1 AL I t2 AL2t 1 AL2t2 AL 3t 1 AL 3t2 AL 4t 1 AL 4t2	**Time Alarms** The user can set delayed or sequential alarms as shown in table 3 by defining times T1 and T2. To disable this function just set zero for T1 and T2.

7.3. FUNCTION CYCLES

F.Func	**F KEY FUNCTION** - Options are **oFF** - Key no used. **Hold** - Hold PV **AL.oFF** - Alarm disabled **rESEt** - Resets Peak and Valley **PHoLd** -Peak Hold **tArE** - Tare zeroing These functions are described in item 5.2.
d IG. In	**Digital Input Function** - The same function available for the **F** key: **oFF** - **Hold** - **AL.oFF** - **rESEt** - **PHoLd** - **tArE** Refer to item 5.2.
F ILtr	**Input Digital Filter** - Adjustable from 0 to 20, this is used to reduce instability of the measured value. 0 means the filter is off and 20 means maximum filtering. The higher the filter value the lower is the measured value response.
oFSEt	**Display Offset** - This a value which is added to the PV to offset any measurement deviation or sensor error. The offset is shown directly in the programmed engineering unit. For °F measurements the null reference is at 32°F.
bAud	**Baud Rate** - Serial digital communication speed in **bps**. Programmable: 1200, 2400, 4800, 9600 and 19200 bps.
AdrES	**Communication Address** - A number which identifies the instrument in a multidrop network.

7.4. CONFIGURATION CYCLE

In.tYP	**Input Type** - Selects the input signal or sensor type to be connected to the PV terminals. Refer to table 1. Changing this parameter will change all other parameters related to PV and alarms, therefore it should be the first parameter to be set.
dP.PoS	**Decimal Point Position** - Defines the decimal point position in the displayed value. This applies to linear input types 0 to 50mV, 4 to 20mA and 0 to 5V as selected at the "**in.tYP**" prompt.
un It	**Temperature Unit** - Selects °C or °F indication. This prompt is not shown for input types 0 to 50mV, 4 to 20mA and 0 to 5V as selected at the "**in.tYP**" prompt.
Sroot	**Square Root** - This prompt is only shown for input types 0 to 50mV, 4 to 20mA and 0 to 5V as selected at the "**in.tYP**" prompt. Set "YES" and the square root will be applied to the measured value within the limits programmed in "**in.LoL**" and "**in.HiL**". The display will show the low limit value should the input signal be below 1% of the range.

In.LoL	**Input Low Limit** - Sets the low limit for input type 0 to 50 mV, 4 to 20 mA or 0 to 5 V. When the **PV Retransmition** is used this limit defines the corresponding 4 mA (or 0 mA) in relation to the input value.
In.H IL	**Input High Limit** - Sets the high limit for input type 0 to 50 mV, 4 to 20 mA or 0 to 5 V. When the **PV Retransmition** is used this limit defines the corresponding 20 mA in relation to the input value.
SCALE	**Scale Factor** - Multiplies the displayed value by 10 to increase measured range.
out.tY	**Analog Output Type** - Selects the analog output type to either 0 to 20 mA or 4 to 20 mA.

8.5 CALIBRATION CYCLE

All input types are factory calibrated and field calibration is seldom necessary. Should it be required the calibration should only be done by experienced personnel.

If this cycle is accidentally accessed do not touch the [MAX] or [MIN] keys. Just press the index key and go through all cycles until the display shows the main or operation menu.

In.LoC	**Input Low Calibration** - Sets the Process Variable low calibration (offset). Several key strokes at [MAX] or [MIN] might be necessary to increment one digit.
In.H IC	**Input Hi Calibration** - Sets the Process Variable span calibration (gain). Several key strokes at [MAX] or [MIN] might be necessary to increment one digit.
ou.LoC	**Analog Output Low Calibration** - Sets the analog current output low calibration (offset).
ou.H IC	**Analog Output Span Calibration** - Sets the analog current output high calibration (span).
CJ Lo	**Cold Junction Calibration** - Allows the user to adjust the this calibration directly in degrees for achieving best results with thermocouples.
Ht.YPE	**Hardware Type** - These parameters adapts the software to the hardware available and should not be changed by the user. 0 - No options 1 - With alarms 3 and 4 2 - With digital input

8. DIGITAL COMMUNICATION

The indicator can be supplied with an asynchronous RS-485 digital communication interface for master-slave connection to a host computer (master).

The indicator works as a slave only and all commands are started by the computer which sends a request to the slave address. The addressed unit processes the command and sends back the answer.

Broadcast commands (addressed to all indicator units in a multidrop network) are accepted but no response is generated.

8.1. CHARACTERISTICS

- RS-485 compatibility with two-wire bus from the host to up to 31 slaves in a multidrop network topology.
- Up to 247 units can be addressed by the MODBUS RTU protocol.
- Maximum network distance: 1200 m.
- Time of indicator disconnection: Maximum of 2 ms after the delivery of the last byte.
- Communication signals electrically isolated from the rest of the instrument.
- Baud rate: 1200, 2400, 4800, 9600, 19200, 38400 or 57600 bps.
- Number of data bits: 8, without parity or even parity
- Number of stop bits: 1
- Time to start response transmission: 100 ms maximum delay after acknowledging the command.
- Protocol: MODBUS (RTU)

Dois parâmetros devem ser configurados para utilização da interface de comunicação serial: o *Baud-Rate* de Comunicação (parâmetro **bRud**) e o Endereço de Comunicação (parâmetro **Rdr ES**).

RS485 INTERFACE: ELECTRICAL CONNECTION

The RS-485 signals are: D1 = D: Bidirectional data line

D0 = D̄: Inverted bidirectional data line

C = GND: Optional connection. Improves communication performance for long cable runs.

9. PROBLEMS WITH THE INDICATOR

Connection errors or improper configuration will result in malfunctioning of the indicator. Carefully revise all cable connections and programming parameters before operating the unit.

Some error messages will help the user identify possible problems.

Message	Possible Problem
⊔⊔⊔⊔⊔	Measured value is above the programmed sensor or input signal limit.
⊓⊓⊓⊓⊓	Measured value is below the programmed sensor or input signal limit.
− − − − −	Open input. No sensor is connected or the sensor is broken.
Err 1	Pt100 cable resistance is too high or the sensor is badly connected.

Different messages other than the ones above should be reported to the manufacturer. Please inform the serial number if this should occur. the serial number can be viewed at the display by pressing the **BACK** key for about 3 seconds.

The software version of the instrument can be viewed at the time the unit is powered. The instrument might display false error messages when wrongly programmed or when connected to a sensor for which it was not programmed.

10. SPECIFICATIONS

DIMENSIONS:.........................310 x 110 x 37 mm. Approximate weight: 975 g
POWER: .... 100 to 240 Vac/dc ±10 %; 50/60 Hz
　　Max. Consumption:.. 10 VA
ENVIRONMENTAL CONDITIONS:
　　Operating temperature:... 5 to 50 °C
　　Maximum RH: ....80 % up to 30 ºC.
　　.................................. For temperatures above 30 ºC, decrease 3 % per ºC.
　　... for indoor use; Installation category II,
　　　　　　　　　　　　　　　　pollution degree 2; altitude < 2000 m

INPUT ....Keyboard selection of input type (refer to table 1)
　　Internal resolution: .... 19500 levels
　　Display resolution:...12000
　　Input sample rate:..5 per second
　　Accuracy: ....Thermocouples J, K, T, N: 0.25 % of span ±1 ºC
　　..Thermocouple E, R, S, B: 0.25 % of span ±3 ºC
　　...Pt100: 0.2 % of span
　　... 4-20 mA, 0-50 mV, 0-5 V: 0.15 % of span.
　　Input impedance: ....0-50 mV, Pt100 and thermocouples: >10 MΩ
　　...0-5 V: >1 MΩ
　　...0-20 mA, 4-20 mA: 22 Ω
　　Pt100 measurement:............................DIN 43760 standard (α=0.00385)
　　Excitation current: .... 0.750 mA
　　　　　　　　　　　　　3-wire circuit, cable resistance compensation
ANALOG OUTPUT: ...0-20 mA or 4-20 mA, 550 Ω max.; 4000 levels, isolated
RELAY OUTPUT:........ ALM1 and ALM2: SPST: 1.5 A / 240 Vac (3 A / 30 Vdc)
EMC : .... EN 61326-1:1997 and EN 61326-1/A1:1998
SAFETY:....................................... EN61010-1:1993 and EN61010-1/A2:1995
START UP 3 SECONDS AFTER POWER UP;
PROTECTION: IP30

11. ORDERING INFORMATION

N1500G-	RT -	485
A	B	C

A:　Series model:　　　　　　　**1500G**
B:　Analog output:　　　　　　**RT –** (Retransmission of the input signal) or **Blank**
C:Digital Communication:　　**485 –** (RS485, ModBus protocol) or **Blanck**

12. WARRANTY

This product is covered by a 12-month warranty provided the purchaser presents the sales receipt and the following conditions are met:

- Products are covered for one year from the original date of purchase. Please retain the dated sales receipt as evidence of the date of purchase. You will need it for any warranty service

- Within this period, warranty against defects in material and workmanship under normal use is free of charge.

- For repair, send the product and the sales receipt to our address. Expenses and transportation risks are under the purchaser's responsibility.

- This warranty does not cover any damage due to accident, misuse, abuse, or negligence.