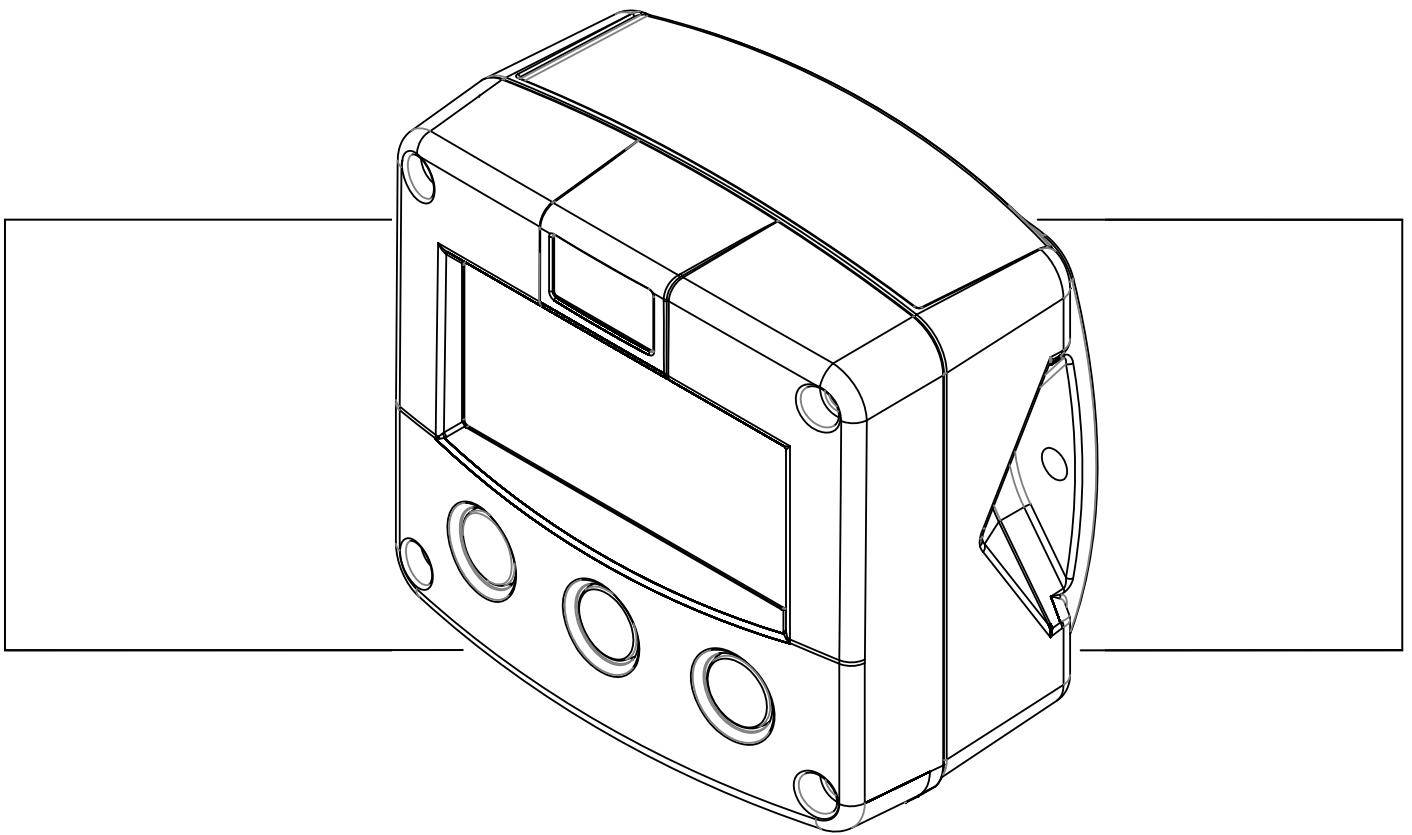# F143-T-OS-PD

TEMPERATURE INDICATOR

WITH HIGH / LOW TEMPERATURE ALARMS

Signal input sensor: PT100 - 2 or 3 wire

Signal outputs: (0)4-20mA / 0-10V ref. temperature

Alarm outputs: four temperature alarm contacts

Options: Modbus communication

$C \in$

⚠ WARNING SAFETY INSTRUCTIONS

- *Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.*

- *LIFE SUPPORT APPLICATIONS: The F143-T-OS-PD is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.*

- *Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.*

- *This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).*

- *Do connect a proper grounding to the aluminum casing as indicated if the F143-T-OS-PD has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.*

DISPOSAL

At the end of its life this product should be disposed of according to local regulations regarding waste electronic equipment. If a battery is present in this product it should be disposed of separately. The separate collection and recycling of your waste equipment will help to conserve natural resources and ensure that it is recycled in a manner that protects the environment.

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F143-T-OS-PD implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F143-T-OS-PD supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:
- The daily use of the unit is described in chapter 2 "Operation". This instruction is meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide an extensive description of all software settings and installing the hardware.

This operation manual describes the standard unit as well as most of the Types available. For additional information, please contact your supplier.

A hazardous situation may occur if the F143-T-OS-PD is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:

A "**warning**" indicates actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or destruction of the F143-T-OS-PD or connected instruments.

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect function of the F143-T-OS-PD or connected instruments.

A "**note**" indicates actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

Hardware version	:	02.01.xx
Software version	:	02.05.xx
Manual	:	HF143TOSEN_v0501_04
© Copyright 2011	:	Fluidwell bv - The Netherlands.

CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F143-T-OS-PD

Functions and features

The temperature indicator model F143-T is a microprocessor driven instrument designed to display the temperature as well as monitoring the temperature with four alarm values for a low-low, low, high and high-high temperature. This product has been designed with a focus on:

▪ ultra-low power consumption to allow long-life battery powered applications (type PB / PC),
▪ intrinsic safety for use in hazardous applications (type XI),
▪ several mounting possibilities with aluminum or GRP enclosures for harsh industrial surroundings,
▪ ability to process all types of temperature signals,
▪ transmitting possibilities with analog, alarm relay contacts (type OR / OS) and communication (option) outputs.

Sensor input

This manual describes the unit with one PT100 input for the temperature sensor "-T version". Other versions are available to process analog (0)4-20mA or 0-10V.
To power the unit, several options are available.

Standard outputs

▪ Configurable alarm outputs: two, three or four alarm outputs, depending on the unit ordered. This manual describes the four alarm outputs version (type OS). The functionality of the outputs can be user defined.
▪ Configurable linear (0)4-20mA or 0-10V analog output with 10-bits resolution mirroring the actual temperature. Temperature levels as well as the minimum and maximum signal output can be tuned.
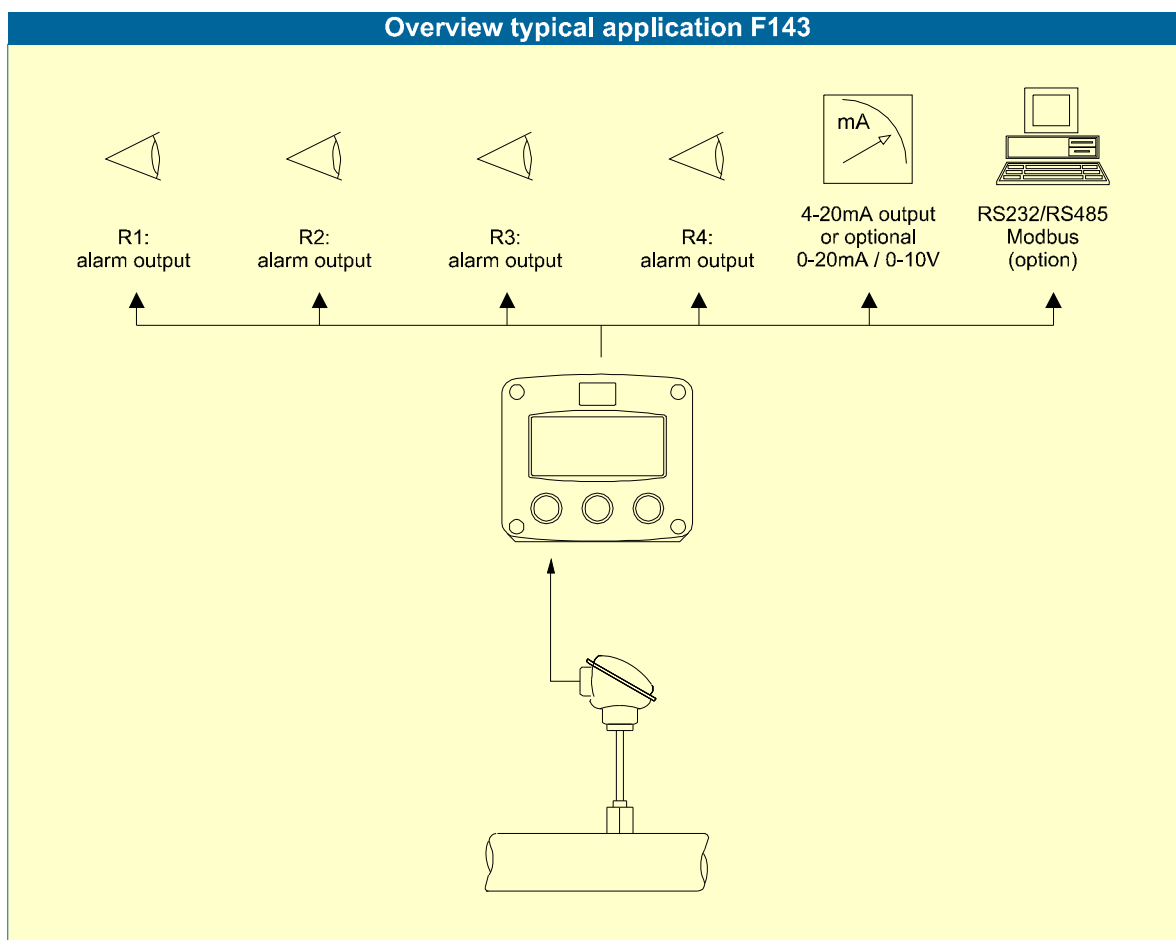

Fig. 1: Typical application for the F143-T-OS-PD.

HF143TOSEN_v0501_04

Configuration of the unit
The F143-T was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F143-T according to your specific requirements. SETUP includes several important features, such as measurement units, signal settings etc. All setting as are stored in EEPROM memory and will not get lost in case of power break-down or empty battery.

Display information
The unit has a large transflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

Options
Depending on the F143-T model the following options may be available: isolated, active or passive 4-20mA / 0-10V / 0-20mA analog output, full Modbus communication RS232/485 (also battery powered), intrinsic safety, mechanic relays or active outputs, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure.

Note !

Important
The number of alarm outputs is related to the configuration ordered:

Type PD:	with 8-30V AC/DC power supply: three or four outputs (type OT, OA or OS)
Type PF:	with 24 V AC/DC mains supply: three outputs (3x type OT, 3x type OA or 2x type OR + 1x type OT / type OA)
Type PM:	with 80-230V mains supply: three outputs (3x type OT, 3x type OA or 2x type OR + 1x type OT / type OA)
Type PX:	with type AP output loop powered: three outputs (type OT)
Type XI:	Intrinsically safe: two outputs (type OT)
Type PD-XI:	Intrinsically safe with 8-30V DC power supply: two outputs (type OT)
Type OS:	relay board with 24V AC/DC mains supply: passive analog output and four relay outputs (type OR).

2. OPERATIONAL

2.1. GENERAL

Caution !

- *The F143-T-OS-PD may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

This chapter describes the daily use of the F143-T-OS-PD. This instruction is meant for users / operators.

2.2. CONTROL PANEL

The following keys are available:

PROG / ENTER   SELECT / ▲   CLEAR / ▶
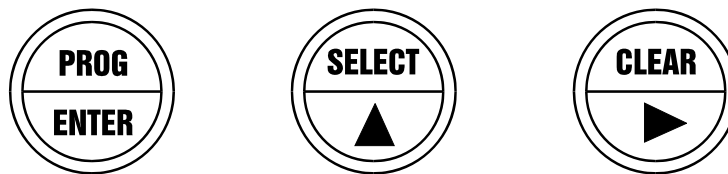
Fig. 2: Control Panel.

Functions of the keys

PROG ENTER
This key is used to program and save new values or settings.
It is also used to get access to SETUP-level; please read chapter 3.

SELECT ▲
This key is used to SELECT other display information or to increase a value.
The arrow-key ▲ is used to configure the unit; please read chapter 3.

CLEAR ▶
This key is used to SELECT other display information or to select a digit.
The arrow-key ▶ is used configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F143-T-OS-PD will always act function at Operator level. The information displayed is dependant up on the SETUP-settings. The sensor signal will be measured by the F143-T-OS-PD in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.
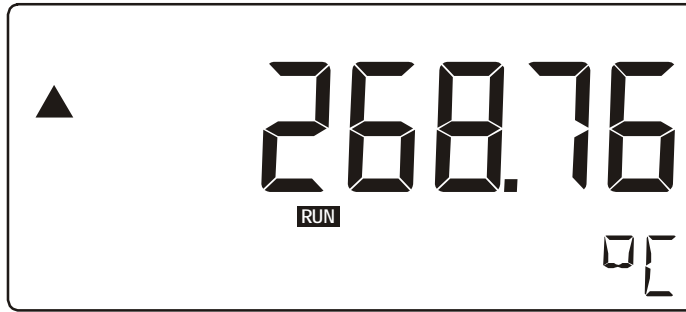

Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

▪ **Display temperature:**

This is the main display information of the F143-T-OS-PD. After selecting any other information, it will always return to this main display automatically. The temperature is displayed with 17mm digits on the upper line. On the bottom line, the measuring unit will be displayed.
When "-------" is shown, then the temperature value is too high to be displayed.
The arrows ⬍ indicate the increase/decrease of the temperature trend.

▪ **Programming the high / low temperature alarm values:**

Remark: this function might not be accessible: it depends on the configuration of the unit..

When the SELECT-key is pressed a few times, the alarm values for low-low, low, high and high-high temperature will be displayed. To change an alarm value, following procedure must be execute:

1) press PROG: the word "PROGRAM" will be flashing,
2) use ▸ to select the digits and ▴ to increase that value,
3) set the new alarm value by pressing ENTER.

Fig. 4: Example display information during programming maximum temperature.

When data is altered but ENTER has not been pressed yet, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for a few seconds: the former value will be reinstated.

- **Temperature alarm:**
  When the actual temperature is outside the allowed range, an alarm message will be displayed at the bottom line of the display indicating the type of alarm, "LO-LO ALARM" for example.
  The alarm is terminated automatically as soon as the temperature is in its range again. Due to the setup configuration it might be that the temperature is outside it's range without an immediate alarm.

- **Low-battery alarm**
  When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after!
  Only original batteries supplied by the manufacturer may be used, else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.

Fig. 5: Example of low-battery alarm.

- **Range error**
  As soon as the input value is outside the calibrated PT100 measurement range (standard range -100°C - +200°C or extended range type ZV: -200° - +800°C), "RANGE ERROR" will be displayed.

- **Alarm 01-04:**
  When "alarm" is displayed, please consult Appendix B: problem solving.

3.   CONFIGURATION

3.1.   INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are provided.

Caution !

- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F143-T-OS-PD may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

3.2.   PROGRAMMING SETUP-LEVEL

3.2.1.   GENERAL

Configuration of the F143-T-OS-PD is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ⬍ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically.
SETUP can be reached at all times while the F143-T-OS-PD remains fully operational.
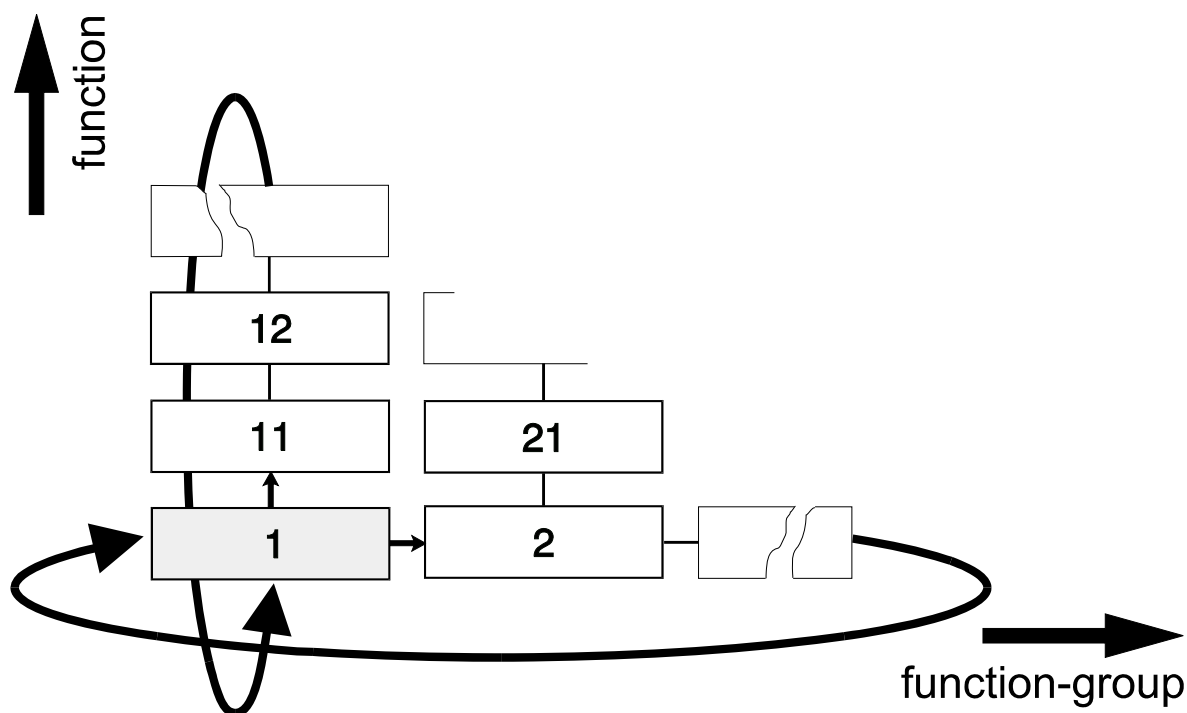
Note !

Note: *A password may be required to enter SETUP. Without this password access to SETUP is denied.*

To enter SETUP-level:
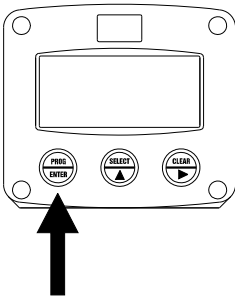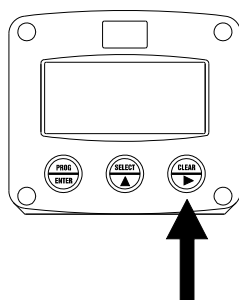
Press (PROG ENTER) for 7 seconds

Matrix structure SETUP-level:

SCROLLING THROUGH SETUP-LEVEL

Selection function-group and function:
SETUP is divided into several function groups and functions.

Select function-group with CLEAR ▶
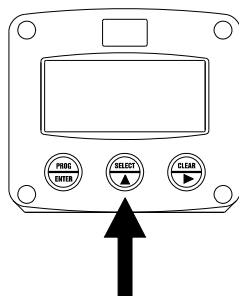
Select function with SELECT ▲

Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected after scrolling through all "active" sub-functions (e.g. 1 ▲, 11 ▲, 12 ▲, 13 ▲, 14 ▲, 1 ▶, 2 ▶, 3 ▲, 31 etc.).

To change or a select a value or value:
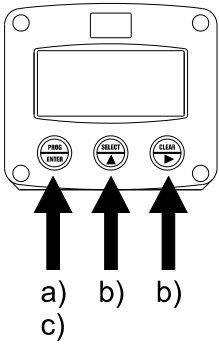
a) press (PROG ENTER) briefly; **PROGRAM** will start flash

b) select or enter value with (SELECT ▲) and / or (CLEAR ►)

c) press (PROG ENTER) to confirm the value / selection.

a) b) b)
c)

To change a value, use ▸ to select the digits and ▲ to increase that value.
To select a setting, both ▲ and ▸ can be used.
When the new value is not valid, the increase sign▲ or decrease-sign▾ will be displayed while you are programming.

When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds: the PROG-procedure will be left automatically and the former value reinstated.

Note !

Note: alterations will only be set after ENTER has been pressed!

To return to OPERATOR-level:
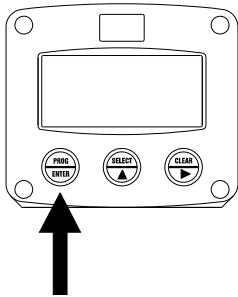
Press (PROG ENTER) for 3 seconds

In order to return to the operator level, PROG will have to be pressed for three seconds. Also, when no keys are pressed for 2 minutes, SETUP will be left automatically.

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TEMPERATURE**		
	11	UNIT	°C - °F - K
	12	OFFSET	-999,999 - +999,999 unit
2	**ALARM**		
	21	ALARM LOW-LOW	-999,999 - +999,999 unit
	22	ALARM LOW	-999,999 - +999,999 unit
	23	ALARM HIGH	-999,999 - +999,999 unit
	24	ALARM HIGH-HIGH	-999,999 - +999,999 unit
	25	DELAY ALARM low-low	0.1 - 999.9 seconds
	26	DELAY ALARM LOW	0.1 - 999.9 seconds
	27	DELAY ALARM HIGH	0.1 - 999.9 seconds
	28	DELAY ALARM high-high	0.1 - 999.9 seconds
3	**DISPLAY**		
	31	ALARM SET	operator - setup
4	**POWER MANAGEMENT**		
	41	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	42	BATTERY MODE	operational - shelf
5	**SENSOR**		
	51	NR. OF WIRES	2 - 3
	52	FILTER	00 - 99
6	**ANALOG**		
	61	OUTPUT	disable - enable
	62	TEMPERAT. MINIMUM	-999,999 - +999,999 unit
	63	TEMPERAT. MAXIMUM	-999,999 - +999,999 unit
	64	CUT-OFF	0.0 - 9.9%
	65	TUNE MIN - 4mA / 0V	0 - 9,999
	66	TUNE MAX- 20mA / 10V	0 - 9,999
	67	FILTER	00 - 99
7	**RELAYS**		
	71	OUTPUT R1	low-low - low - high - high-high - all - off
	72	OUTPUT R2	low-low - low - high - high-high - all - off
	73	OUTPUT R3	low-low - low - high - high-high - all - off
	74	OUTPUT R4	low-low - low - high - high-high - all - off
8	**COMMUNICATION**		
	81	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	82	ADDRESS	1 - 255
	83	MODE	RTU - ASCII - off
9	**OTHERS**		
	91	TYPE / MODEL	
	92	SOFTWARE VERSION	
	93	SERIAL NO.	
	94	PASSWORD	0000 - 9999
	95	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION SETUP-FUNCTIONS

1 - TEMPERATURE	
MEASUREMENT UNIT 11	SETUP - 11 determines the measurement unit for temperature. The following units can be selected: °C - °F - K - no unit Please note that the Span has to be adapted as well; the calculation is not done automatically.
OFF SET 12	In case of a related temperature measurement, it might be required to add a certain temperature to the really measured temperature. The minus for a negative temperature can selected by pressing the center and right button simultaneously.

Note !

2 - ALARM

With these settings, it is determined how the temperature will be monitored and the functionality of the transistor / relay outputs be determined.

Please be aware that the alarm temperatures can be programmed at operator level as well.

Moreover, the function be locked (setup 31).

Note: for transistor / relay output functions: read SETUP 7 "relays".

ALARM VALUE LOW - LOW 21	The low-low alarm is set with this setting. An alarm will be generated as long as the temperature is lower as this value. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.
ALARM VALUE LOW 22	The low alarm is set with this setting. An alarm will be generated as long as the temperature is lower as this value. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.
ALARM VALUE HIGH 23	The high alarm is set with this setting. An alarm will be generated as long as the temperature is higher as this value. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.
ALARM VALUE HIGH - HIGH 24	The high-high alarm is set with this setting. An alarm will be generated as long as the temperature is higher as this value. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.
DELAY TIME ALARM LOW - LOW 25	An alarm generated by SETUP 22 "low-low" can be ignored during X-time period. If the actual temperature is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM LOW 26	An alarm generated by SETUP 23 "low" can be ignored during X-time period. If the actual temperature is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM HIGH 27	An alarm generated by SETUP 24 "high" can be ignored during X-time period. If the actual temperature is still incorrect after this delay time, then an alarm will be generated.
DELAY TIME ALARM HIGH - HIGH 28	An alarm generated by SETUP 25 "high-high" can be ignored during X-time period. If the actual temperature is still incorrect after this delay time, then an alarm will be generated.

3 - DISPLAY

ALARM SET 31	With this function it is determined if the operator can enter alarm values or not. If "SETUP" is selected, the operator is still able to read the values but can not change them.

4 - POWER MANAGEMENT

When used with the internal battery option, the user may hold the concern of reliable measurement over a long period of time. The F143-T-OS-PD has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:

LCD NEW 41	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is **strongly advised** to select a slow refresh-rate. Please understand that NO information will be lost; the signal will be processed and the output-signals will be generated in the normal way. The following can be selected: Fast - 1 sec - 3 sec - 15 sec - 30 sec - off. **Example 3:** **Battery life-time** *battery life-time with FAST update: about 1 years.* *battery life-time with 1 sec update: about 3 years.* *Note: after a button has been pressed, the display refresh-rate will always be FAST during 30 seconds. When "OFF" is selected, the display will be switched-off after 30 seconds till a button has been pressed.*
Continued next page >>>	

Note !

4 - POWER MANAGEMENT (CONTINUED)

BATTERY-MODE **42**	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not process the signal, the display is switched-off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake-up the unit again; press the SELECT-key twice.

5 - SENSOR

NUMBER OF WIRES **51**	Do enter the number of wires the PT100 element has: 2 or 3.
FILTER **52**	The output signal of a sensor does mirror the actual temperature. This signal is measured several times a second by the F143-T-OS-PD. The value measured is a "snap-shot" of the real temperature as it will be fluctuating. With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value. The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with there response times are indicated:

FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.3 seconds	0.5 seconds	1.0 seconds	1.8 seconds
03	0.5 seconds	1.0 seconds	1.5 seconds	3 seconds
05	1.0 seconds	1.8 seconds	2.8 seconds	5.3 seconds
10	1.8 seconds	3.5 seconds	5.6 seconds	11 seconds
20	3.5 seconds	7.0 seconds	11 seconds	23 seconds
30	5.3 seconds	10 seconds	17 seconds	34 seconds
50	8.8 seconds	17 seconds	29 seconds	57 seconds
75	13 seconds	26 seconds	43 seconds	86 seconds
99	17 seconds	34 seconds	57 seconds	114 seconds

6 - ANALOG OUTPUT

A linear analog (0)4-20mA or 0-10V signal is generated according to the temperature with a 10 bits resolution. The settings for temperature (SETUP - 1) influence the analog output directly.
The relationship between temperature and analog output is set with the following functions:

Note !

DISABLE / ENABLE **61**	The analog output can be disabled. In case of a passive analog output type AP, 3.5mA will be generated if a power supply is available but the output is disabled.
MINIMUM TEMPERATURE **62**	Enter here the temperature according which the output should generate a 4mA signal (or 0mA / 0V) - in most applications at minimum temperature. The number of decimals displayed is according to SETUP 12. The measuring units (°C for example) is according SETUP 11 but can not be displayed. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.
MAXIMUM TEMPERATURE **63**	Enter here the temperature according which the output should generate a 20mA (or 10V) - in most applications at maximum temperature. The number of decimals displayed is according to SETUP 12. The measuring units (°C for example) is according SETUP 11 but can not be displayed. The **minus** for a **negative** temperature can be selected by pressing the center and right button simultaneously.

Continued next page >>>

6 - ANALOG OUTPUT (CONTINUED)

CUT-OFF 64		A low-temperature cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the temperature is less than the required value, the current will be 4mA. **Examples:**		
4MA (SETUP 62)	20MA (SETUP 63)	CUT-OFF (SETUP 64)	REQUIRED RATE	OUTPUT
0 °C	100 °C	2%	(100-0)*2% = 2.0 L	4+(16*2%) = 4.32mA
20 °C	800 °C	3.5%	(800-20)*3.5%= 27.3 L	4+(16*3.5%)=4.56mA

TUNE MIN / 4MA 65	The initial minimum analog output value is 0/4mA or 0V. However, this value might differ slightly due to external influences such as temperature for example. The 0/4mA or 0V value can be tuned precisely with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not being used for any application!* After pressing PROG, the current will be about 4mA (or 0mA / 0V). The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed "up-side-down" if desired, so 20mA at minimum temperature for example!

TUNE MAX / 20MA 66	The initial maximum analog output value is 20mA (or 10V). However, this value might differ slightly due to external influences such as temperature for example. The 20mA value (or 10V) can be tuned precisely with this setting. ▪ *Before tuning the signal, be sure that the analog signal is not being used for any application!* After pressing PROG, the current will be about 20mA. The current can be increased / decreased with the arrow-keys and is <u>directly active</u>. Press ENTER to store the new value. Remark: the analog output value can be programmed "up-side-down" if desired, so 4mA at maximum temperature for example!

FILTER 67		This function is used to stabilize the analog output signal. The output value is update every 0.1 second. With the help of this digital filter a more stable but less actual reading can be obtained. The filter principal is based on three input values: the filter level (01-99), the last analog output value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with there response times are indicated:		
FILTER VALUE		RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE. TIME IN SECONDS		
		50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01		filter disabled	filter disabled	filter disabled	filter disabled
02		0.1 second	0.2 second	0.4 second	0.7 second
03		0.2 second	0.4 second	0.6 second	1.2 seconds
05		0.4 second	0.7 second	1.1 seconds	2.1 seconds
10		0.7 second	1.4 seconds	2.2 seconds	4.4 seconds
20		1.4 seconds	2.8 seconds	4.5 seconds	9.0 seconds
30		2.1 seconds	4 seconds	7 seconds	14 seconds
50		3.5 seconds	7 seconds	11 seconds	23 seconds
75		5.2 seconds	10 seconds	17 seconds	34 seconds
99		6.9 seconds	14 seconds	23 seconds	45 seconds

7 - RELAY OUTPUT

Note !

With "SETUP 2", four alarm levels can be entered. The F143-T-OS-PD has 4 alarm (relay) outputs.

OUTPUT R1 **71**	Assign the output function to output R1. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R2 **72**	Assign the output function to output R2. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R3 **73**	Assign the output function to output R3. Following can be selected: low-low - low - high - high-high alarm - all alarms - off
OUTPUT R4 **74**	Assign the output function to output R4. Following can be selected: low-low - low - high - high-high alarm - all alarms - off

8 - COMMUNICATION (OPTIONAL)

Functions as described below deal with hardware that are not part of the standard delivery.
Programming of these functions does not have any effect if this hardware has not been installed.
Consult Appendix C and the Modbus communication protocol description for a detailed explanation.

BAUDRATE **81**	For external control, following communication speeds can be selected: 1200 - 2400 - 4800 - 9600 baud
BUS ADDRESS **82**	For communication purposes, a unique identity can be attributed to every F143-T-OS-PD. This address can vary from 1-255.
MODE **83**	The communication is executed according Modbus protocol RTU mode. With OFF, the communication is disabled.

9 - OTHERS

|	
TYPE OF MODEL **91**	For support and maintenance it is important to have information about the characteristics of the F143-T-OS-PD. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
VERSION SOFTWARE **92**	For support and maintenance it is important to have information about the characteristics of the F143-T-OS-PD. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER **93**	For support and maintenance it is important to have information about the characteristics of the F143-T-OS-PD. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
PASSWORD **94**	All SETUP-values can be password protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER **95**	For identification of the unit and communication purposes, a unique tagnumber of maximum 7 digits can be entered.

4.   INSTALLATION

4.1.   GENERAL DIRECTIONS

Caution !

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F143-T-OS-PD may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " at the front of this manual.

4.2.   INSTALLATION / SURROUNDING CONDITIONS
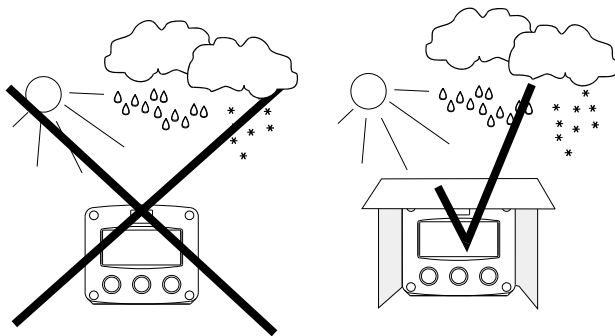
Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.
When panel-mounted, the unit is IP65 (NEMA 4X)!
When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.
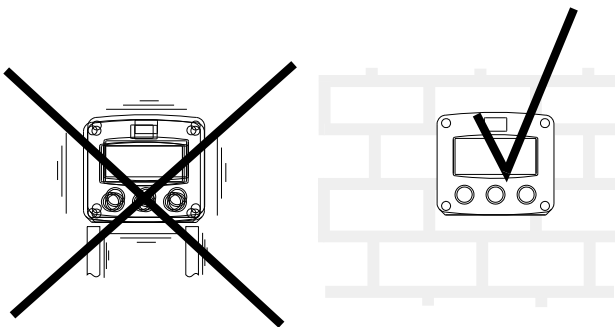
Mount the F143-T-OS-PD on a solid structure to avoid vibrations.

4.3.   DIMENSIONS- ENCLOSURE
Aluminum enclosures:

120 mm (4.72")   130 mm (5.12")   75 mm (2.95")   60 mm (2.36")   112 mm (4.40")

HA
30mm 30mm   22,5mm
PG9   M20 x 1,5   PG9

HP
12mm 12mm   17mm 14mm
24mm 24mm
36mm 36mm   6 x M12

HM
30mm 30mm   22,50mm
M16 x 1,5   M20 x 1,5   M16 x 1,5

HT
0.9"
1/2"NPT

HN
22,5mm
M20 x 1,5

HU
0.12" 0.12"   0.9"
3x 1/2"NPT

HO
25mm 25mm   22,5mm
M20 x 1,5   M20 x 1,5

HV
23 15 15 23   16 15
mm
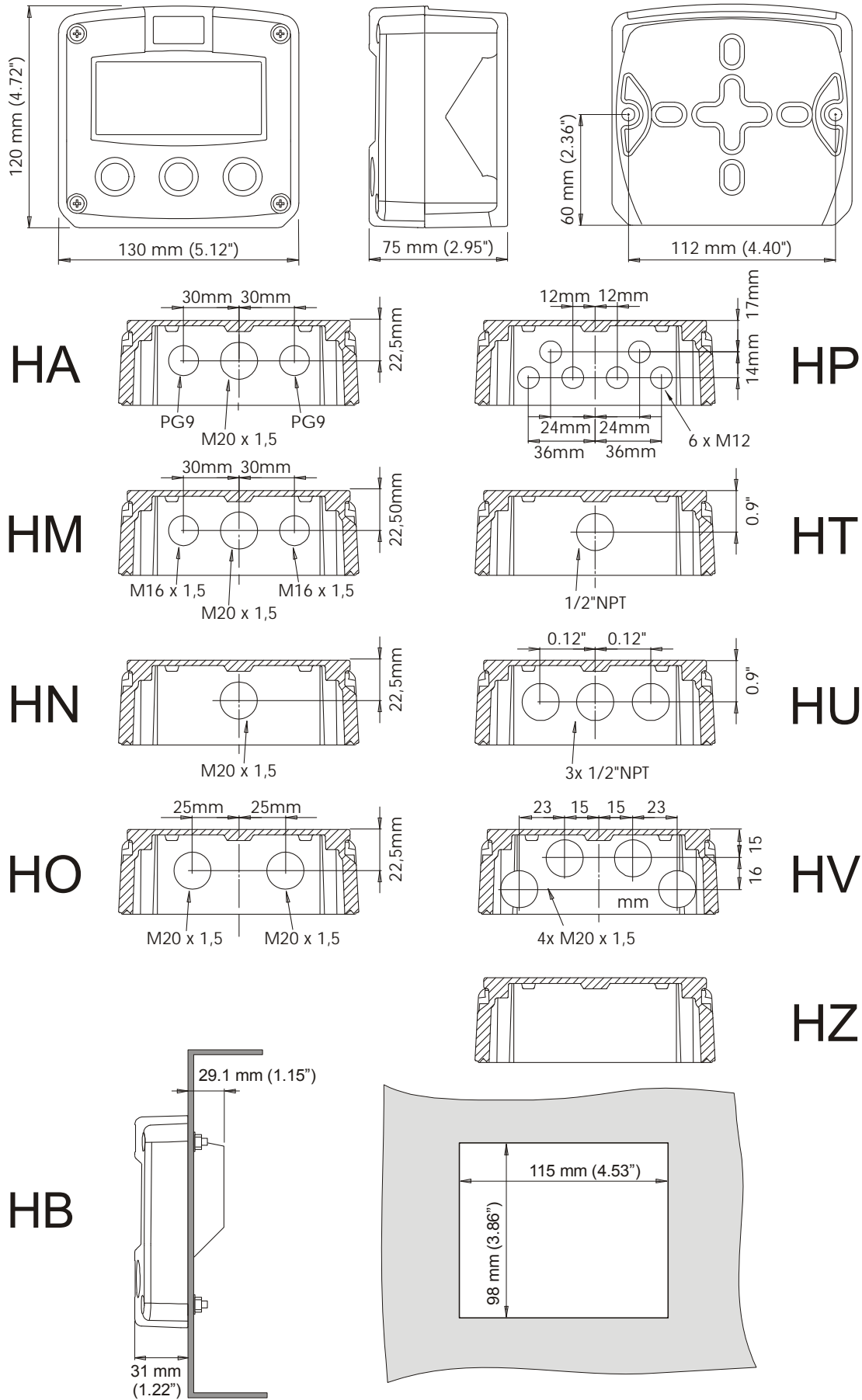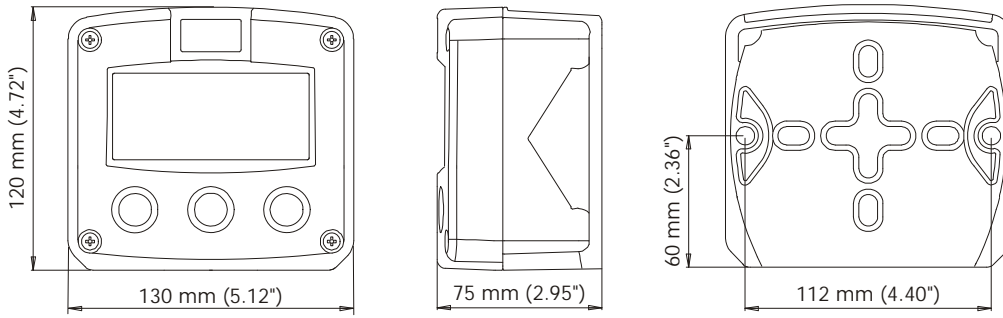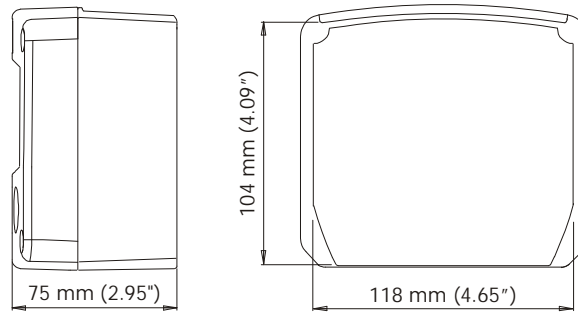4x M20 x 1,5

HZ

HB
29.1 mm (1.15")
31 mm (1.22")
115 mm (4.53")
98 mm (3.86")

Fig. 6: Dimensions aluminum enclosures.

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GRP enclosures:

120 mm (4.72")
130 mm (5.12")
75 mm (2.95")
60 mm (2.36")
112 mm (4.40")

HK back box:
(flat bottom)

75 mm (2.95")
104 mm (4.09")
118 mm (4.65")

HD
HK

HG
25mm 25mm
22,5mm
D=20mm D=20mm

HE
30mm 30mm
22,5mm
D=16mm D=16mm
D=20mm

HH
12mm 12mm
17mm
14mm
24mm 24mm
36mm 36mm
D=12mm

HF
0.9"
D=22mm (0.866")

HJ
0.12" 0.12"
0.9"
3x D=22mm (0.866")

HC
29.1 mm (1.15")
31 mm (1.22")
115 mm (4.53")
98 mm (3.86")
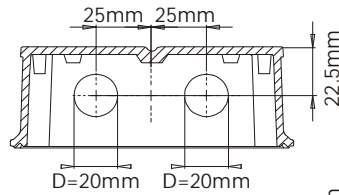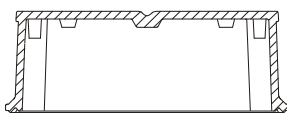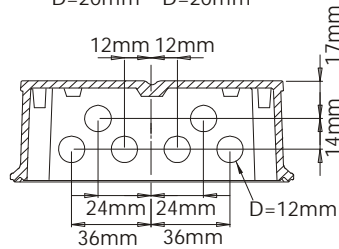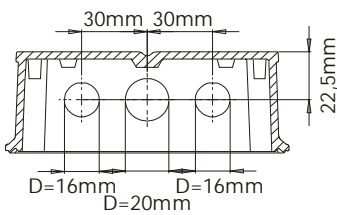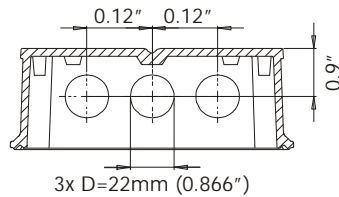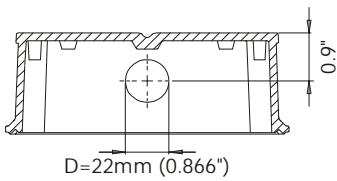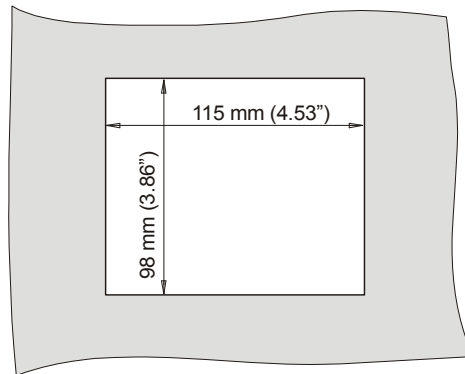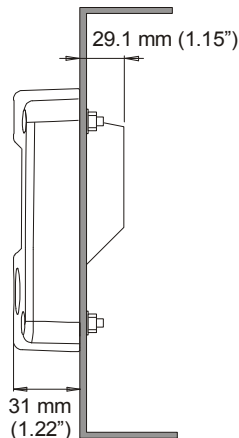
Fig. 7: Dimensions GRP enclosures.

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4.4. INSTALLING THE HARDWARE

4.4.1. INTRODUCTION

⚠️ **WARNING**
- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.

- This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).

⚠️ **WARNING**
Aluminum enclosures
- When installed in an aluminum enclosure and a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.

- Do ground the aluminum enclosure properly as indicated, if the F143-T-OS-PD has been supplied with an AC power-supply. The green / yellow wire between the back-casing and removable terminal-block may never be removed.
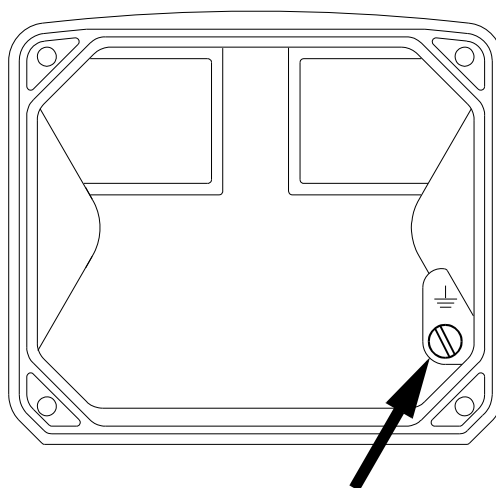
Fig. 8: Grounding aluminum enclosure.

FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

- Separate cable glands with effective IP67 (NEMA4X) seals for all wires.
- Unused cable entries: ensure that you fit IP67 (NEMA4X) plugs to maintain rating.
- A reliable ground connection for both the sensor, and if applicable, for the metal casing.
- An effective screened cable for the input signal, and grounding of its screen to terminal 9 (GND) or at the sensor itself, whichever is appropriate to the application.

4.4.2. TERMINAL CONNECTORS

The following terminal connectors are available:
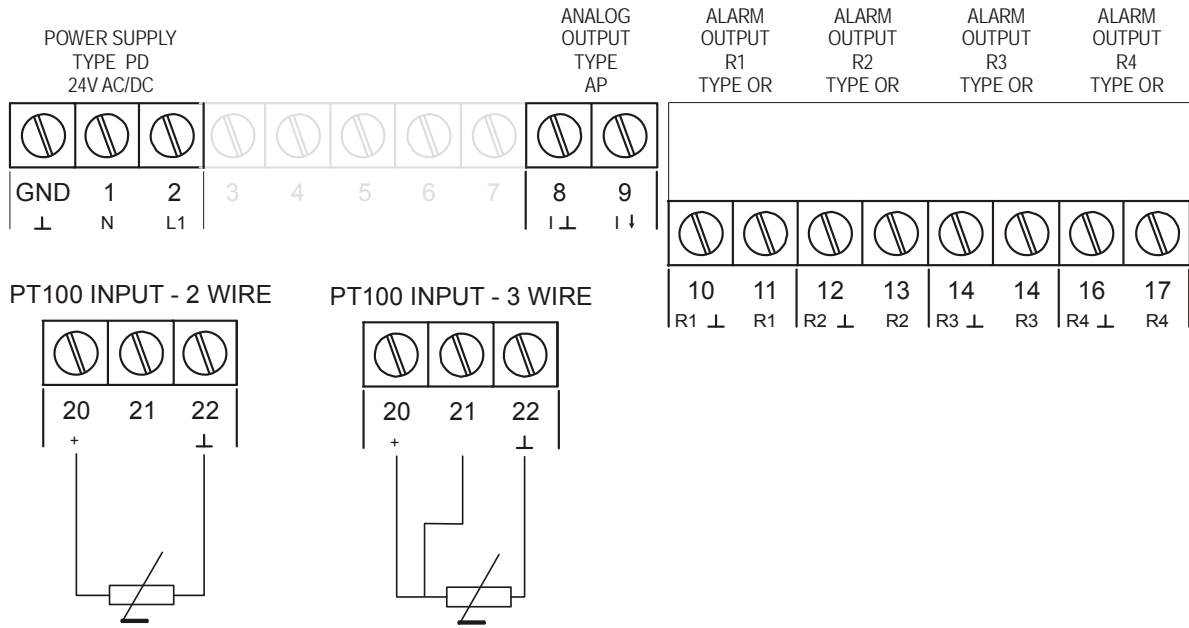
Fig. 9: Overview terminal connectors configuration F143-T-OS-PD and options.

REMARKS TERMINAL CONNECTORS:

Terminal GND- 01- 02; power supply - <u>only available with type PD</u>:

OPTION		SENSOR SUPPLY*	Terminal			backlight	OPTION AA	OPTION AU	option OA	option OR
			GND	01	02					
PD	24V AC	8,2-12-24V max 50mA		AC	AC		◊	◊	◊	
PD	24V DC	8,2-12-24V max 50mA	L-	L+			◊	◊	◊	

- Only applicable for units with analog or pulse inuts.

Terminal 20-22; Sensor input:
The F143-T requires a 2 wire or 3 wire PT100 element which signal will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.

PT100 INPUT - 2 WIRE   PT100 INPUT - 3 WIRE
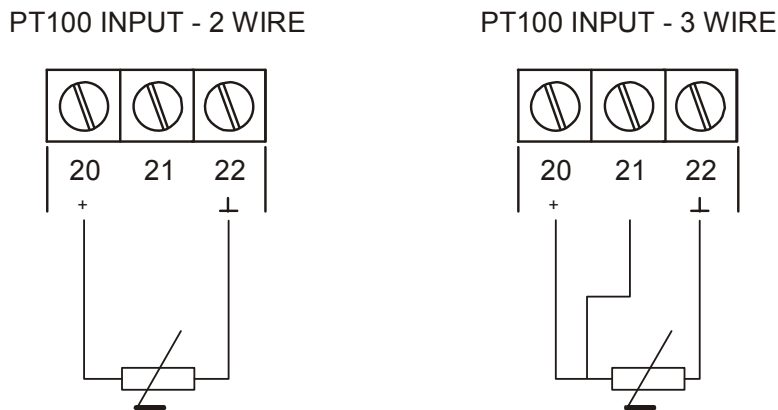
Terminal 10-17; relay outputs

All relay contacts are normally open (NO).

Relay output R1 through R4 are wired to terminals 10-11 through 16-17 and can be configured with setup 81 through 84 respectively.
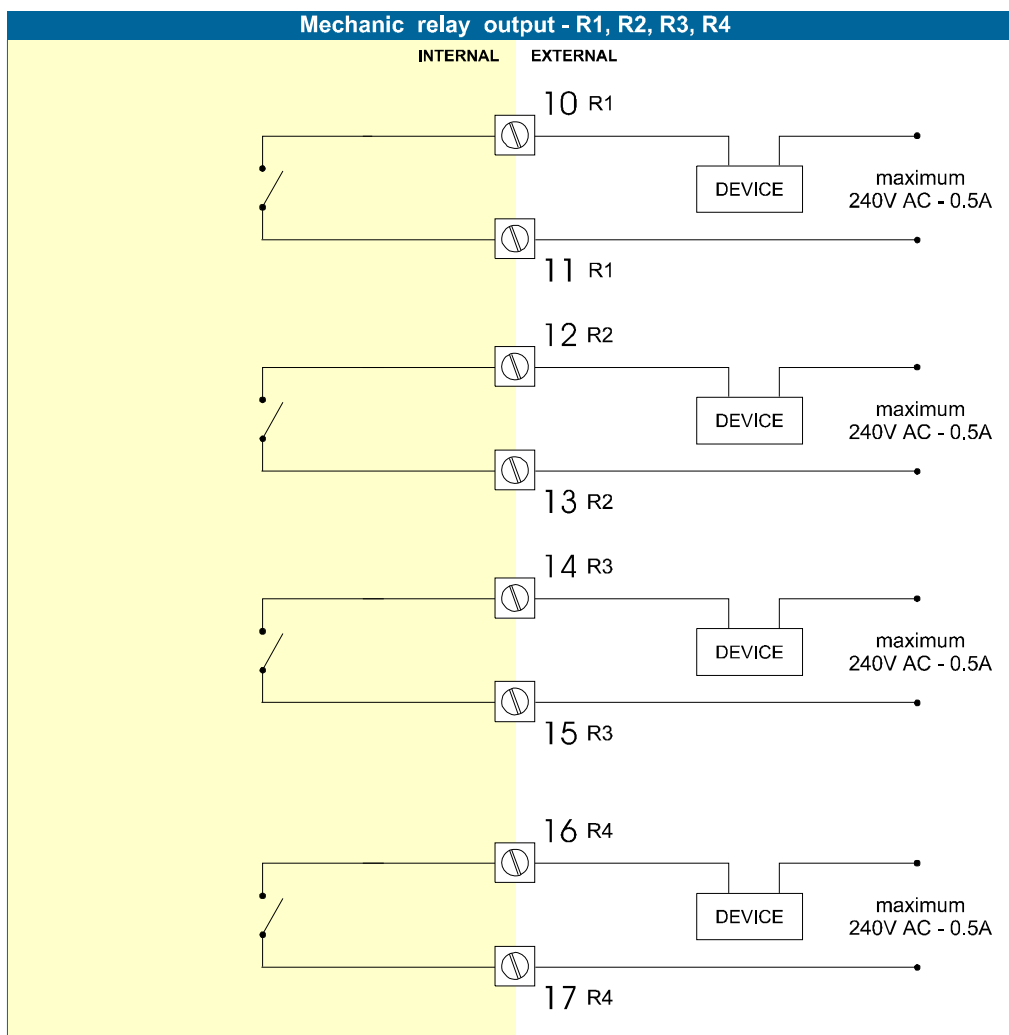
Terminal 08-09 analog output (SETUP 6) :

An analog output signal proportional to the temperature is available as standard.

Type AP:

A 4-20mA current-sinking signal proportional to the level is available as standard.
A DC power supply, with the actuator in series, should be connected to terminal 08 and 09. The current is then regulated by the F143-T-OS-PD.

When a power supply is connected but the output is disabled (SETUP 61), a 3.5mA signal will be generated. Max. driving capacity 1000 Ohm.

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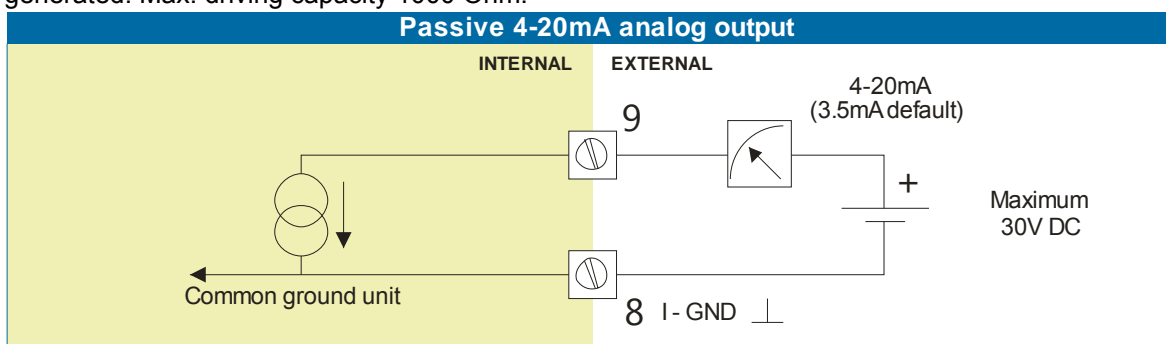
Terminal 26-31: type CB / CH / CI / CT - communication RS232 / RS485 / TTL (option)

- Full serial communications and computer control in accordance with RS232 (length of cable max. 15 meters) or RS485 (length of cable max. 1200 meters) is possible.
- Read the Modbus communication protocol and Appendix C.

Fig. 10: Overview terminal connectors communication option.

When using the RS232 communication option, terminal 27 is used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V). If no active signal is available it is possible to connect a separate supply between terminals 26 and 27 with a voltage between 8V and 24V.
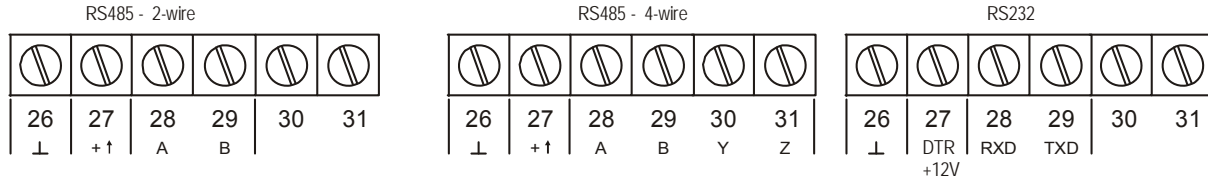
Terminal 26-31: backlight - type ZB (option):

Note: if the unit is supplied with a power supply type PD, PF or PM, the backlight supply is integrated, so the text following is not applicable.

To power the backlight, provide a 12-24V DC to terminal 26 (-) and 27 (+). An external trimmer 1kOhm trimmer can be used to tune the brightness of the backlight, or if not desired, a short-cut between these terminals have to be made which will result in the maximum brightness.

Note: Intrinsically Safe as well as 4-wire RS485 communication is not possible in combination with type ZB, except if a PD, PF or PM power supply is being used.
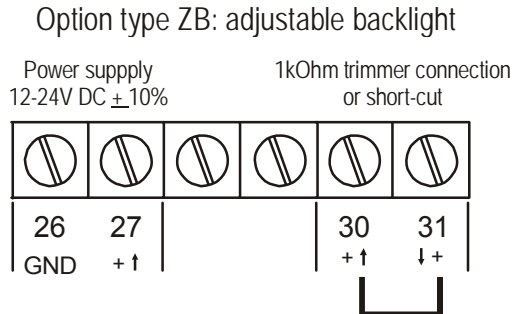

Option type ZB: adjustable backlight

Fig. 11: Overview terminal connectors backlight option.

5. MAINTENANCE

5.1. GENERAL DIRECTIONS

Caution !

- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F143-T-OS-PD may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

The F143-T-OS-PD does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is the users responsibility to take all precautions to dehumidify the internal atmosphere of the F143-T-OS-PD in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

Check periodically:
- The condition of the casing, cable glands and front panel.
- The input/output wiring for reliability and aging symptoms.
- The process accuracy. As a result of wear and tear, re-calibration of the sensor might be necessary. Do re-enter any subsequent Span alterations.
- The indication for low-battery.
- Clean the casing with soapy-water; don't use any aggressive solvents as these might damage the coating.

APPENDIX A: TECHNICAL SPECIFICATION

GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Type ZB	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.

Enclosures	
General	Die-cast aluminum or GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-resistant silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Panel-mount enclosures	Dimensions: 130 x 120 x 60mm (5.10" x 4.72" x 2.38") – LxHxD.
Classification	IP65 / NEMA4X
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Type HC	GRP panel-mount enclosure
Type HB	Aluminum panel-mount enclosure
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10″ x 4.72″ x 2.95″) – LxHxD.
Classification	IP67 / NEMA4X
Aluminum enclosures	
Type HA	Drilling: 2x PG9 – 1x M20.
Type HM	Drilling: 2x M16 – 1x M20.
Type HN	Drilling: 1x M20.
Type HO	Drilling: 2x M20.
Type HP	Drilling: 6x M12.
Type HT	Drilling: 1x ½″NPT.
Type HU	Drilling: 3x ½″NPT.
Type HV	Drilling: 4x M20
Type HZ	No drilling.
GRP enclosures	
Type HD	No drilling.
Type HE	Drilling: 2x 16mm (0.63″) – 1x 20mm (0.78″).
Type HF	Drilling: 1x 22mm (0.87″).
Type HG	Drilling: 2x 20mm (0.78″).
Type HJ	Drilling: 3x 22mm (0.87″).
Type HH	Drilling: 6x 12mm (0.47″).
Type HK	Flat bottom - no drilling.
ABS enclosure	
Type HS	Silicone free ABS enclosure with EPDM and PE gaskets. UV-resistant polyester keypad. (no drilling)

Operating temperature	
Operational	-40°C to +80°C (-40°F to +176°F)

Power supply	
Type PD	8-24V AC / DC ± 10%. Power consumption max. 10 Watt. Intrinsically safe: 16-30V DC; power consumption max. 0.75 Watt.

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm2 and 2.5mm2 (Type PM / PF)

Data protection	
Type	EEPROM backup of all setting. Backup of running totals every minute. Data retention at least 10 years.
Pass code	Configuration settings can be pass code protected.

Hazardous area (option)	
Explosion proof Type XD/XF	ATEX approval ref.: <EX> II 2 GD EEx d IIB T5. Weight appr. 15kg. Dimensions of enclosure: 350 x 250 x 200mm (13.7″ x 9.9″ x 7.9″) LxHxD.

Environment	
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993).

INPUTS

Sensor	
Type T	PT100 2 wire or 3 wire. Range -100°C to +200°C (-148°F to +392°F) accuracy ± 0.5°C.

OUTPUTS

Analog output	
Function	transmitting actual temperature.
Accuracy	10 bit. Error < 0.05% - update 10 times a second. Software function to calibrate the 4.00mA and 20.00mA levels precisely within set-up.
Load	max. 1 kOhm
Type AP	Passive 4-20mA output - output loop powered.

Alarm outputs	
Function	low, low-low, high, high-high or all alarms output.
Type OS	Four mechanic relay outputs for alarms. Requires type AP + PD and OR. Not Intrinsically Safe.

Communication option	
Functions	reading display information, reading / writing all settings.
Protocol	Modbus ASCII or RTU
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Type CB	RS232
Type CH	RS485 2-wire
Type CI	RS485 4-wire
Type CT	TTL Intrinsically Safe communication.
Type CX	no communication.

OPERATIONAL

Operator functions	
Displayed functions	• actual temperature • low-low alarm value • low alarm value • high alarm value • high-high alarm value

Temperature	
Digits	6 digits.
Units	°C - °F - K
Decimals	0 - 1 - 2 or 3.

APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F143-T-OS-PD is going to be installed or while it is in operation.

Analog output does not function properly:
Check:
▪ SETUP 61 - is the function enabled?
▪ SETUP 62 / 63: are the temperature-levels programmed correctly?
▪ connection of the external power-supply according specification.

Alarm output does not function:
Check:
▪ SETUP 71 - 74 - did you enable the relays?
▪ SETUP 2 - alarm: are the correct alarm values programmed

The password is unknown:
If the password is not 1234, there is only one possibility left: call your supplier.

ALARM
When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. The codes are:

0001:   irrecoverable display-data error: data on the display might be corrupted.
0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.
0003:   error 1 and error 2 occurred simultaneously

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

APPENDIX C: COMMUNICATION VARIABLES

Remarks:
- Below, an overview of the F143-T-OS-PD specific variables; other common variables are described in the standard table.
- All numbers are <u>decimal numbers</u>, unless otherwise noted.
- Following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

VAR	DESCRIPTION	BYTES	VALUE	REMARKS
CONFIGURATION VARIABLES F143-T-OS-PD - SETUP-LEVEL:				
TEMPERATURE				
48 (30h)	unit	1	0=K 1=°C 2=°F 3=no unit	
50 (32h)	decimals	1	0…1	
51 (33h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals span	1	0…6	
ALARMS				
234 EAh	temperature low	3	0-9,9999	decimals: see 50 (32h)
237 EDh	temperature high	3	0-9,9999	decimals: see 50 (32h)
205 CDh	delay time alarm low temperature	2	1…9,999	steps of 0.1 second
DDh	delay time alarm high temperature	2	1…9,999	steps of 0.1 second
44h	edit temperature alarm	1	0=operator 1=SETUP level	
46h	alarm at temperature zero	1	0=ignore 1=default 2=no relay	
DISPLAY				
68 (44h)	set temperature monitor	1	0=operator level 1=SETUP level	
POWERMANAGEMENT				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
SENSOR				
99 (63h)	filter	1	0….99	

	ANALOG OUTPUT			
112 (70h)	analog output	1	0=disable 1=enable	
113 (71h)	minimum rate	3	0..9999999	unit, time, decimals acc. var48-50
116 (74h)	maximum rate	3	0..9999999	unit, time, decimals acc. var48-50
119 (77h)	cut off percentage	1	0..99	steps of 0.1%
120 (78h)	tune minimum rate	2	0..9999	
122 (7Ah)	tune maximum rate	2	0..9999	
99 (63h)	filter	1	0….99	
VAR	**DESCRIPTION**	**BYTES**	**VALUE**	**REMARKS**
	OTHERS			
168 (A8h)	password	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

OTHER F143-T-OS-PD VARIABLES FOR COMMUNICATION

TEMPERATURE - variable number 572 (23Ch) – 4 bytes
READ TEMPERATURE: The value difference as mentioned with total/acc. total might appear here too.
WRITE TEMPERATURE: Impossible.

INDEX OF THIS MANUAL

LIST OF FIGURES IN THIS MANUAL

LIST OF CONFIGURATION SETTINGS

SETTING	DEFAULT	DATE :	DATE :
1 - TEMPERATURE			
11 unit	°C		
12 offset	0		
2 - ALARM			
21 alarm low-low	0		
22 alarm low	0		
23 alarm high	0		
24 alarm high-high	0		
25 delay alarm low-low	0.0 sec		
26 delay alarm low	0.0 sec		
27 delay alarm high	0.0 sec		
28 delay alarm high-high	0.0 sec		
3 - DISPLAY			
31 alarm set	operator		
4 - POWER MANAGEMENT			
41 LCD-new	1 sec.		
42 mode	operational		
5 - SENSOR			
51 no. of wires	3		
52 filter	01 (off)		
6 - ANALOG OUTPUT			
61 output	disabled		
62 min. temperature - 4 mA	0.0		
63 max. temperature - 20 mA	9999.9		
64 cut off percentage	0.0%		
65 tune min - 4mA	0160		
66 tune max - 20mA	6656		
67 filter	10		
7 - RELAY OUTPUT			
71 output R1	off		
72 output R2	off		
73 output R3	off		
74 output R4	off		
8 - COMMUNICATION			
81 baud-rate	2400		
82 address	1		
83 mode	BUS-ASC		
9 - OTHERS			
91 model	F143-T	F143-T	F143-T
92 software version			
93 serial number			
94 password	0000		
95 tagnumber	0000000		