Warranty Certificate

This instrument is warranted against any manufacturing defects for a period of twelve months from the date of installation, or eighteen months from the date of supply, which ever is early.

Kindly note that:

1. *The warranty is limited to repairing the instrument and no responsibility is taken for any other damage resulted*
2. *The warranty will be void if the instrument is opened or tampered in any way*
3. *The faulty instrument has to be returned to our factory, carriage prepaid & duly insured.*

Product Category : Programmable Process Controller

Model No. : FIT 7223

Serial number : _____

Date of despatch : _____

Authorized signatory : _____

Company seal

The Inside Stuff

Kindly forward this product manual to the end user. The user is requested to read the manual thoroughly before operating the instrument.

As you unpack

Congratulations
on buying a
Programmable Process Controller!

As you unpack kindly ensure that
1. The material received is in good condition
2. You have received the following material:
   a) Programmable Process Controller as per your order
   b) Mounting bracket pair
   d) This manual along with Warranty certificate

In case of any discrepancies contact our customer support department immediately.

We are sure you will get long and trouble free service from our system.

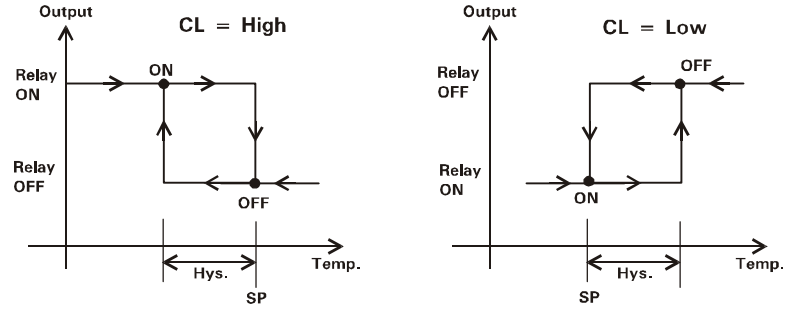
We need your feedback :

Every attempt is made to make this manual clear and easy to understand, so that the user can install, take care of and feel confident in using our product. We welcome your valued suggestions to help us improve this product as well as the document and make it more user friendly.

Important Terms

1) **Control Logic (CL) :** The logic for relay actuation, i.e.
   a) *CL* = High Control Action. The control action is such that the process temperature must not go above the setpoint. Process value < Setpoint Relay ON
   This is generally used in heating applications.
   b) *CL* = Low Control Action. The control action is such that the process temperature must not go below the setpoint. Process value > Setpoint Relay ON
   This is generally used in cooling applications.

2) **Hysteresis :** The On / Off differential gap for an On / Off controller. Figures below show the hysteresis for both high and low control logic.



Arrows indicate Process temperature trajectory.
SP = Setpoint
HYS = Hysteresis

ESD - FIT 9225 / 9223 LED DISPLAY - 6 DIGIT TOTALIZER

Totalizer Calculations

ESD FIT will send Totalizer value for Modbus Read Function 04 and 03, with Start Address 10 and Quantity 3. Enter the data received in the Values column to get the Totalizer Value

	Position	Values	Multiplier	Sub Total
Low byte	0		1	0
	1		100	0
High byte	2		10000	0
Totalizer Value =				0

	Position	Values	Multiplier	Sub Total
Low byte	0	68	1	68
	1	7	100	700
High byte	2	24	10000	240000
Totalizer Value =				240768

ESD - FIT 7223 LCD DISPLAY - 10 DIGIT TOTALIZER

Totalizer Calculations

ESD FIT will send Totalizer value for Modbus Read Function 04 and 03, with Start Address 10 and Quantity 5. Enter the data received in the Values column to get the Totalizer Value

	Position	Values	Multiplier	Sub Total
Low byte	0		1	0
	1		100	0
	2		10000	0
	3		10000000	0
High byte	4		1000000000	0
Totalizer Value =				0

	Position	Values	Multiplier	Sub Total
Low byte	0	68	1	68
	1	7	100	700
	2	24	10000	240000
	3	14	1000000	14000000
High byte	4		100000000	0
Totalizer Value =				14240768

Introduction

Flow indicators and totalizers play an mportant part in any process industry. Quick and accurate measurement and control of a process value will improve the final product quality, reliability and reduce rejection.

Process indication and control is therefore one of the prime considerations in any process industry

The FIT 7223 series is a Microcontroller based Process Indicator cum Controller with user friendly programming facility. The FIT 7223 has been designed for fast and accurate measurement and control of process value. Linearisation of signals provides high accuracy even for most nonlinear sensors. The instrument is designed using highly reliable electronic components. Process value is displayed directly in digits, giving better resolution.

The FIT 7223 accepts 4 - 20 mA as input. Wide ranges of measurements are available depending on the sensor used.

The instrument is immune to mechanical vibrations. Even the mounting position will not affect the measurement accuracy.

Use of highly reliable electronic components with low tempearature coefficient ensures long and trouble free service.The instrument is tested for its performance under various climatic conditions.

Principle of Operation :

The FIT 7223 series is based on the principle high input impedance amplifier feeding an analog to digital convertor. The input signal generated by the transducer is fed to a signal conditioning amplifier, output of which is digitised by the ADC. This digital signal is linearised by software, displayed and compared to the set value by the microcontroller which initiates the programmed relay action. The linearisation, display and relays are controlled by the microcontroller by virtue of the system software.

Features :

- Microcontroller based logic
- Linearisation of controlled variable achieved through software giving high accuracy
- Highly compact
- Dust and vermin proof enclosure with epoxy powder coating.
- User selectable Control Logic
- Programming through tactile membrane keys
- NVRAM enables data storage even in events of prolonged power failure
- Fast response time
- RS 232 / RS 485 Modbus protocol supported
- Fail safe relay logic
- Maximum MTBF and minimum MTTR

Function : Read Input Registers (04)

Message Format : (Request initiated by the master)

Slave Address	Function Code	Start Address		No. of points		CRC	
		(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	03 or 04	00	00	00	03	xx	xx

Message Format : (Response by the slave for the request initiated by the master)

Slave Address	Function Code	Start Address	Flow value		1st setpoint value		2nd setpoint value		CRC	
		(Hi)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	03 or 04	xx	xx	xx	xx	xx	xx	xx	xx	xx

Function : Read Input Registers (04)

Message Format : (Request initiated by the master)

Slave Address	Function Code	Start Address		No. of points		CRC	
		(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	03 or 04	00	0a	00	05	xx	xx

Message Format : (Response by the slave for the request initiated by the master)

Slave Address	Function Code	Start Address	Decimal value for digit 1 & 2		Decimal value for digit 3& 4		Decimal value for digit 5& 6		Decimal value for digit 7 &8		Decimal value for digit 9 &10		CRC	
		(Hi)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	03 or 04	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

Function : Read Input Registers (16)

Message Format : (Response by the slave for the request initiated by the master)

Slave Address	Function Code	Address value		Quantity value		Number of points	1st setpoint value		2nd setpoint value		CRC	
		(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	10	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

Message Format : (Request initiated by the master)

Slave Address	Function Code	Start Address		No. of points		CRC	
		(Hi)	(Lo)	(Hi)	(Lo)	(Hi)	(Lo)
xx	10	xx	xx	xx	xx	xx	xx

Modbus Protocol

Communication : RS 232 or RS 485 2 wire
Protocol : MODBUS RTU
Device Address : Programmable from 1 to 247
Baud Rate : Selectable between 1200, 2400, 4800 or 9600 kbps
Parity : None
Data bits : 8
Stop bits : 1

Functions supported :
1. Read Input Registers (03 or 04)
2. Preset Multiple Registers (16)

Exception Codes :
1. Invalid Function Code (01)
2. Invalid Start Address (02)
3. Invalid Data Value (03)

Starting Address	Contents of the location
0000	Process Value
0001	Value of Setpoint No - 1
0002	Value of Setpoint No - 2

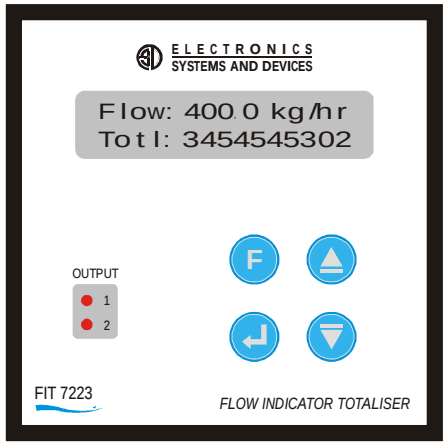
Specifications

Model : FIT 7223
Control action : On / Off
Range : Programmable from 0 to 9999
Input : 4 - 20 mA
Indication accuracy : +/- 0.1 % of FS +/- 1 digit
Accuracy deviation due to
a) Temperature change : +/- 0.02 % / °C , ref at 25 °C
b) Supply Variation : +/- 0.01 % /V
No. of Setpoints : Two
Setpoint Adjust and Read : Through Flat Membrane key pads and 4 digit display respectively on front panel
Outputs : 1 set of potential free Relay change over contacts rated 5 Amp resistive at 230 V AC per setpoint
: 24 V DC, +/- 1 V, @ 30 mA supply
Relay logic : User selectable High or Low logic.
Relay ON indication : By Red LED per setpoint
On / Off hystersis : Programmable from 0.2 to 9.9 %
Display : 16 x 2 Alfa Numeric LCD with back LED
Character size : 2.95 (W) x 4.35(H) mm
Power supply : 230 V AC, +/- 10 % , 50 Hz
Ambient Temp. range : 0 to 55 °C
Sensor break indication : Up scale [OPEn]
Sensor break protection : Relay 'Off' (Relay 'On' by demand)
Relative Humidity : 90 % Non Condensing
Power consumption : 6 VA
Weight : 900 grams
Mounting : Flush panel mounting
Dimensions : 96 (W) x 96 (H) x 120 (D) mm
Cutout : 92 x 92 mm, +1, -0 mm

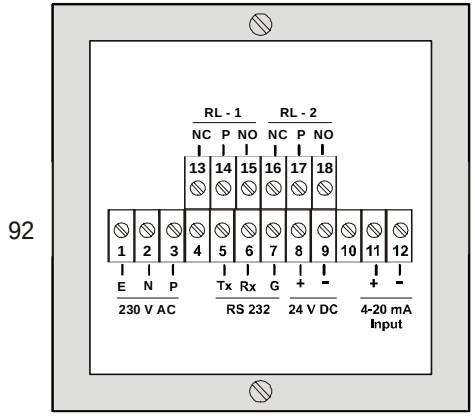
Communication : RS 232 / RS 485
Protocol : Modbus RTU
Device Address : Programmable between 1 to 247
Baud Rate : Selectable between 1200 to 9600 kbps
Programming protection : Password protected. Default password is 191.

Illustrations

A) Front view



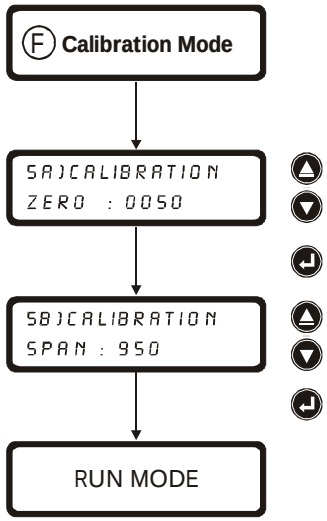
B) Rear View



Output Calibration procedure

Warning : This procedure is to be carried out strictly by technically qualified personnel only.

The instrument is calibrated at the factory using 0.05 % accurate calibrating instruments. No calibration should be required in normal case, however if the instrument requires re-calibration, the procedure to be followed is given below.



For output calibration connect a multimeter at the mA output terminals. The password for output calibration is191.

When display show zero message then by using increment and decrement key set 4 mA on the multimeter. Display shows output count. Press enter key.

When display show span message then by using increment and decrement key set 20 mA on the multimeter. Display shows output count. Press enter key.

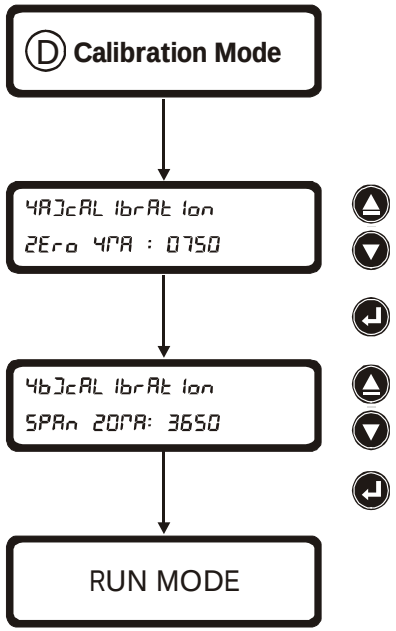
Note :

1. **All values followed by Enter key will be stored, else the value will be discarded.**
2. **All modes have password protection. Default password is 191.**

Input Calibration procedure

Warning : This procedure is to be carried out strictly by technically qualified personnel only.

The instrument is calibrated at the factory using 0.05 % accurate calibrating instruments. No calibration should be required in normal case, however if the instrument requires re-calibration, the procedure to be followed is given below.



Feed 4 mA from a stable source. Unit displays the ADC count corresponding to input.

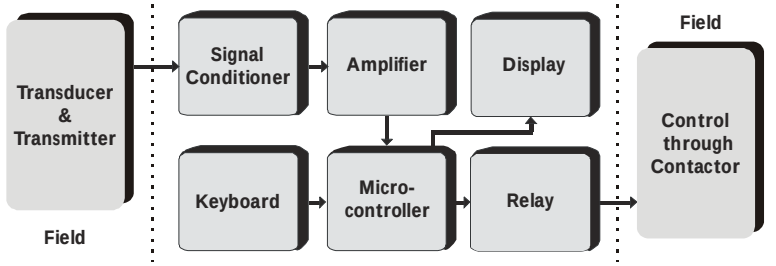
Feed 20 mA from a stable source. Unit displays the ADC count corresponding input given.

Note :

1. All values followed by Enter key will be stored, else the value will be discarded.
2. All modes have password protection. Default password is 191.

Operation

Block Diagram



1. **Transducer :** This is externally connected to the instrument. Types available are 4-20 / 0-20 mA current signal
2. **Signal conditioner:** This circuit accepts the process signal from the sensor performs the necessary compensation (Ambient compensation for T/C and lead wire compensation for PT- 100) and converts it into suitable signal level for ADC.
3. **ADC:** This is a 12 bit Successive Approximation type ADC inbuilt the microcontroller. It accepts the analog input signal, converts it into digital data and feeds it to the processor for further action.
4. **Microcontroller**: This is the heart of the unit and is inter faced to all other peripherals. The transducers, membrane keypad, display, memory and output relays function under the command of the microcontroller.
5. **Memory :** There are two memory elements provided in the circuit. One is the EPROM for monitor (main) program storage and the other is the NVRAM for storage of various user

programmed parameters and process variables (even in events of prolonged power failure).

6. **Keypad :** Feather touch membrane keys are provided on the front panel for user programming. These keys have features like long life, negligible contact bounce, ease of operation.
7. **Display :** The front panel carries all the indications. These are controlled by the CPU. 16 column x 2 rows Alfa numeric LCD display is used for indicating various messages and parameter values. 2 LED's indicate the relay status of 2 corre sponding setpoints . This acts as an interface between user and CPU.
8. **Output relays :** There are two relays, one for each setpoint.

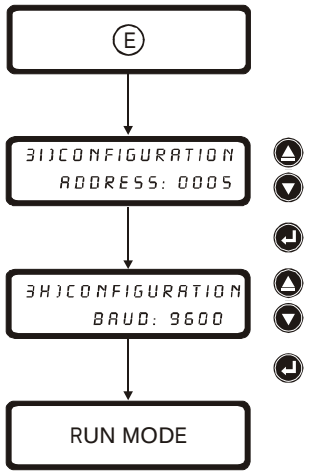
9. **RS 232 :** Serial port is for communication with a PC. For mode details on this, pls refer the modbus protocol section.

Modes of Operations :

1. **Program Mode :**
   In this mode the user can program all the setpoints, control action etc.

2. **Run Mode :**
   In this mode the display shows the process value.

For programming sequence please refer program flow chart.



The device address can be set between 1 to 247

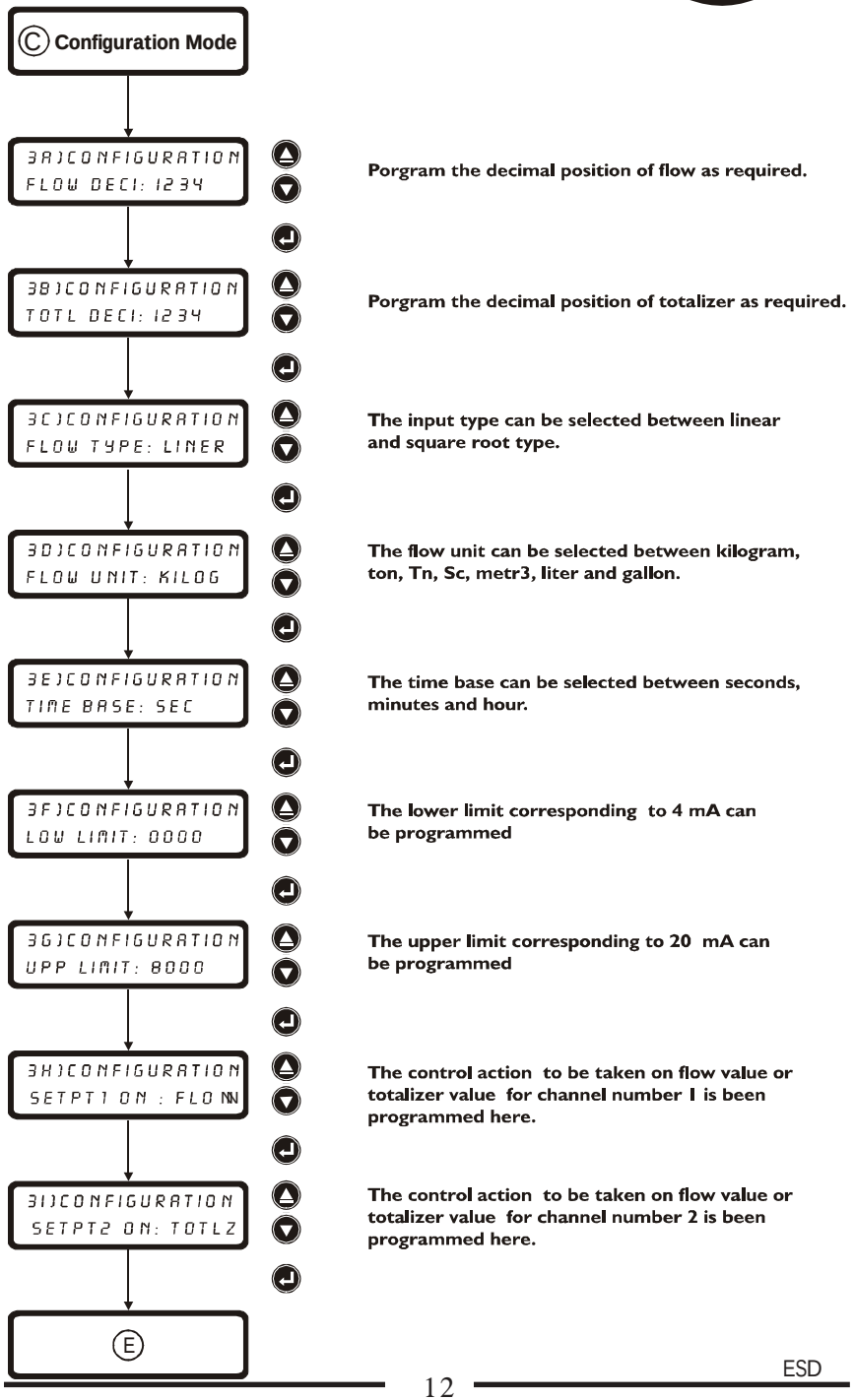
The baud rate in kbps is selectable between 1200, 2400, 4800 or 9600.

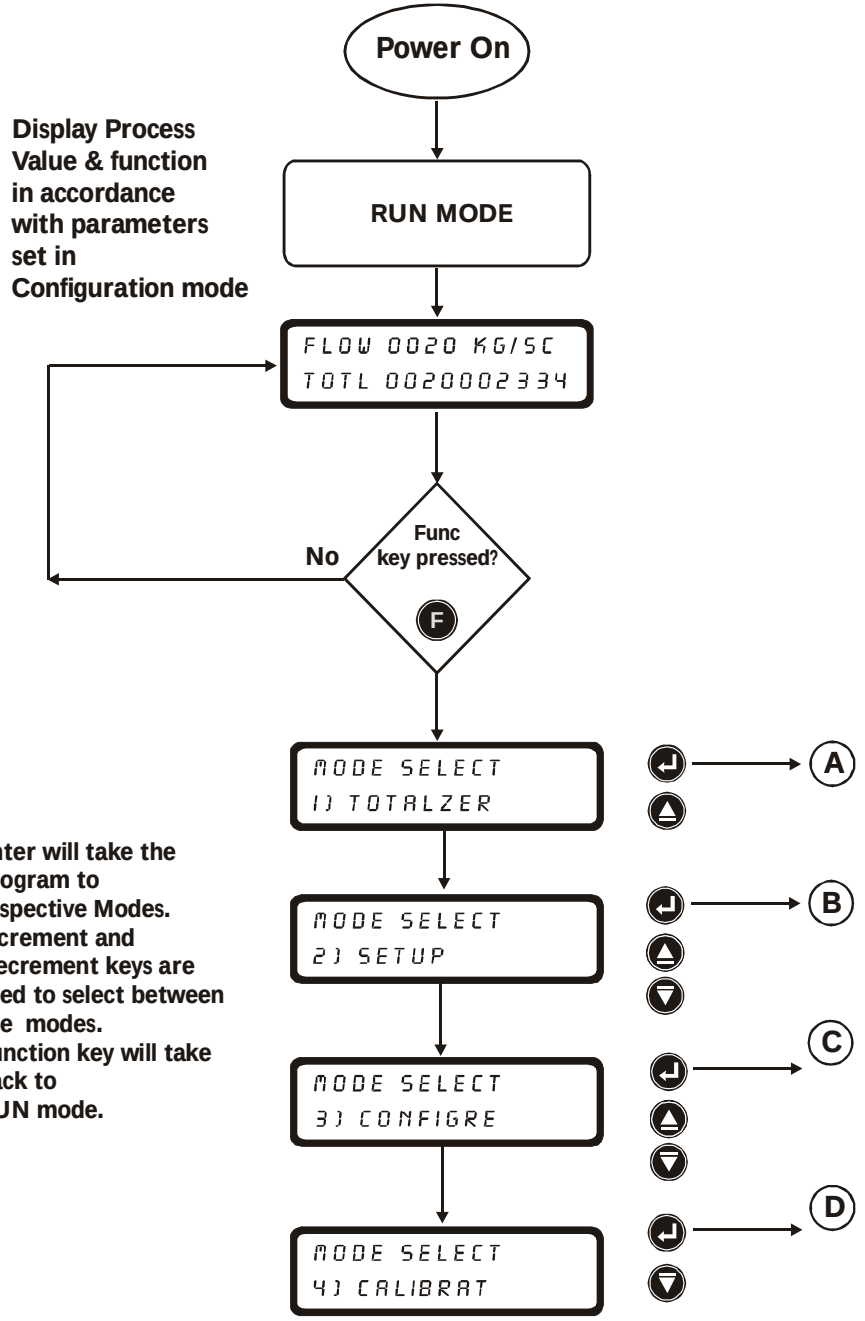
Installation procedure :

Also observe **"Precautions"** as given in this manual

The instrument should be mounted in a place where it is clearly visible and accessible.

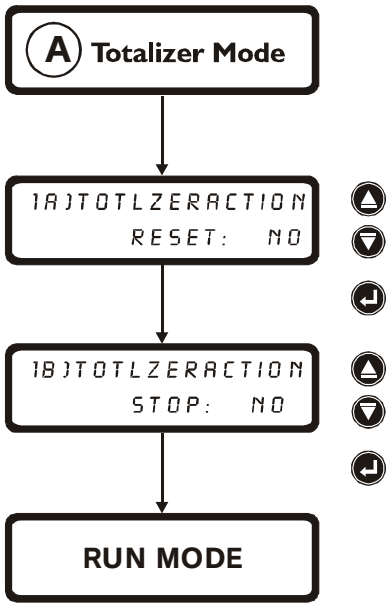
1. Insert the instrument in a suitable cut out and fix it using the bracket pair provided on the sides.
2. Make the connections as shown in Rear View diagram.
3. All connections should be firm.
4. Connect the positive of the transmitter to ' + ' terminal and negative of power supply to ' - ' terminal. i.e Connet the terminals in series with the transmitter.
5. Ensure proper earthing to the instrument.
6. Connect the RS 485 2 wires to the master instrument.





Display Process Value & function in accordance with parameters set in Configuration mode

1. Enter will take the program to respective Modes.
2. Increment and Decrement keys are used to select between the modes.
3. Function key will take back to RUN mode.

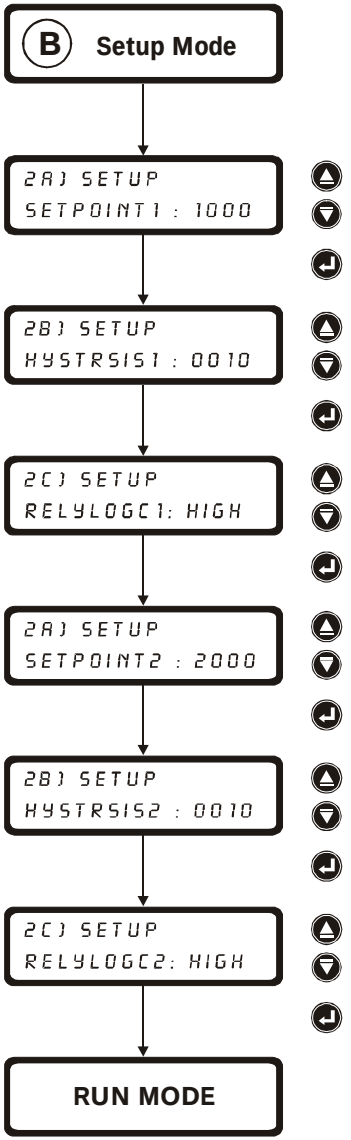


User can reset the totalizer value over here by selecting "YES".

User can stop the totalizer action by selecting "YES"

Note :

1. **In program mode if function key (F) is pressed at any point, unit will branch to auto mode.**
2. **All values followed by Enter key will be stored, else the value will be discarded.**
3. **All modes have password protection. Default password is 191.**



Program the setpoint no. 1 value.

Program the hysterisys of setpoint no. 1 between 2 to 255 counts

Program the relay logic of setpoint no. 1 between high or low logic

Program the setpoint no. 2 value.

Program the hysterisys of setpoint no. 2 between 2 to 255 counts

Program the relay logic of setpoint no. 2 between high or low logic

Note :

1. **In program mode if function key (F) is pressed at any point, unit will branch to auto mode.**
2. **All values followed by Enter key will be stored, else the value will be discarded.**
3. **All modes have password protection. Default password is 191.**