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 purchase, which ever is early.

Kindly note the following:

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*

Product Category : Intelligent Series

Model No. : _____

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
Data Acquisition System

As you unpack kindly ensure that
1. The material received is in good condition
2. You have received following material:
   i) Data Acquisition System as per your order
   ii) Mounting bracket pair.
   iii) This manual along with Test & Warranty certificate
   iv) Software Installation CD
   v) RS 485 to RS 232 convertor with serial interface cable

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 at ESD welcome your valued suggestions to help us improve this product as well as the document and make it more user friendly.
Your suggestions are recorded and implemented in the next version. Ten best suggestions are awarded every year .
Please mail your suggestions on esdcdi@vsnl.com

RS 485 to RS 232 convertor datasheet

Fault diagnosis

1. *Erroneous / Irrelevant indication*
   Improper sensor
   Improper sensor connection
   Calibration error.
   System Hang (Restart the system).

2. *No indication on display*
   No Supply .
   Supply voltage not as per specifications.
   Loose PCB interconnections.
   System Hang (Restart the system).

3. `OPEn' *indication on display*
   Improper sensor connection.
   Sensor open.

4. *Fluctuations in Readings*
   Supply voltage not within specified limit.
   Sensor faulty / improper sensor connection.
   Noise pick-up on sensor / sensor cable (use proper shielding / isolation).
   Excessive ambient temperature.

5 *No alarm and trip indication*
   Sensor connection faulty
   Settings incorrect

If a problem persists please contact our customer service department immediately.

Introduction

Temperature Indicators and Controllers play an important part in any process industry. Quick and accurate measurement and control of a process temperature will help to improve the final product quality, reliability and reduce rejection. Temperature indication and control is therefore one of the prime considerations in any process industry.

When the process is complex and critical, the measurement locations are many and they have inter-relationship between one another which needs to be recorded, analysed and stored. In such a situation Data Acquisition System becomes a necessity. The Intelligent series serves this purpose very effectively.

The ESD Data Acquisition System (DAS) series is based on microcontroller and is designed for fast and accurate measurement and control of temperature. The instrument is designed using highly reliable electronic components. This series accepts all types of Thermocouples, Pt - 100, 0 to 20 mA as well as 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. The large bright red LED seven segment display allows long distance readability. Use of highly reliable electronic components with low

temperature coefficient ensure long and trouble free service.The instrument is tested for its performance under various climatic conditions. ESD's DAS offer communication to PC. The data from the instrument is logged on to the PC in a file. The data in these files can be opened in a spread sheet package like MS-Excel so as to obtain various graphs and carry out trend analysis

Principle of operation

The ESD Intelligent 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 sensor compensation circuit, where automatic ambient compensation in case of thermocouple & lead resistance compensation in case of Pt-100 is achieved. Duly compensated signal is fed to a signal conditioning amplifier, output of which is given to CPU through ADC. The linearization of the input signal from the transducer is done by software. This linearized signal is directly displayed on the display and compared with the set value by processor. Depending upon the status of input w.r.t. set point output to the relay driver is activated.

The processor scans all the inputs at a very fast rate and stores it in the memory. This stored data and programmed set values are displayed automatically as per the preset scan times.

Features :

- Proven field performance
- Highly compact
- Dust & vermin proof enclosure with epoxy powder coating.
- LED display gives better readability at long range
- Fast response time
- RS 485 for long distance communication
- Designed for Thermocouples, RTD and 4 - 20 mA input
- Fail safe relay logic
- Maximum MTBF and minimum MTTR
- User friendly front facia and display.

Precautions

Taking care of your equipment is just as important as buying the best equipment. So simply take the following precautions and ensure a long, trouble- free service from your temperature measurement and control system.

Use

- Three wire system for connecting Pt-100 sensor to the instrument.
- Same area of cross section for all the three wires.
- Appropriate compensating cables for connecting T/C to an instrument
- Appropriate Thermally conductive media between Thermowell & sensor sheath.
- Proper sheathing material as per application and environment.
- Proper size crimped wire termination lugs with insulated sleeves & ferrule no's.
- Proper size screw driver for making connections to the terminations and also while adjusting calibration and set points.
- Fuses of correct ratings for mains and relay outputs.

Do's

- Sensor cables must be isolated from power cables.
- Insert minimum required sensitive length in the measurement object.
- Operating temperature should be 80 % of the maximum specified temperature.
- Check that all the wiring is firm and as per wiring diagram.
- Recalibrate instruments only when errors are confirmed with the help of certified calibrators.
- Output loads connected should be within specified limits.
- Select a Sensor / Instruments / Instrumentation Panel manufacturer who has the required technical knowledge and infrastructure inhouse.

Avoid

- Terminal joints or junction boxes. Only firm soldered joints must be made if necessary.
- Exposure of thermocouple head to temperatures greater than 90°C.
- Too large sheath diameter as this may introduce time lag.
- Mechanical stresses and vibrations.
- Sharp objects for operating front panel membrane keys.
- Excessive relative humidity.
- Magnetic field / inductive pick up / noise.
- Excessive Ambient temperature variations.
- Direct radiant heat.
- Corrosive gasses in the surroundings.
- Chemicals or pressure wash for cleaning instruments.
- Excessive tightening of mounting accessories.
- Excessive light from being incident on displays.

Look-up Table

Temperature V/s Sensor output

Temp in°C	**Pt-100** Res. in Ω	**T/C Output** in mV (Reference junction at 0°C)			
		Fe-Ko (J)	Cr-Al (K)	Pt-Pt-13% Rh (R)	Pt-Pt-10% Rh (S)
-150	39.71	-6.499	-4.912	-	-
-100	60.25	-4.632	-3.553	-	-
-50	80.31	-2.431	-1.889	-	-
-25	90.13	-1.239	-0.368	-	-
0	100.00	0.000	0.000	0.000	0.000
10	103.90	0.507	0.397	0.111	0.055
15	105.85	0.762	0.597	0.082	0.084
20	107.79	1.019	0.798	0.171	0.113
22	108.57	1.122	0.879	0.123	0.125
24	109.35	1.225	0.960	0.135	0.137
26	110.12	1.392	1.041	0.147	0.148
28	110.90	1.432	1.122	0.158	0.161
30	111.67	1.536	1.203	0.232	0.173
32	112.45	1.640	1.285	0.183	0.185
34	113.22	1.745	1.366	0.195	0.197
36	113.99	1.849	1.468	0.207	0.210
38	114.77	1.994	1.529	0.220	0.222
40	115.54	2.058	1.611	0.296	0.235
50	119.40	2.585	2.022	0.363	0.299
60	123.24	3.115	2.436	0.431	0.365
70	127.07	3.649	2.850	0.501	0.432
80	130.89	4.186	3.266	0.573	0.502
90	134.70	4.725	3.681	0.643	0.573
100	138.50	5.268	4.095	0.723	0.645
120	146.06	6.359	4.919	0.879	0.795
140	153.58	7.457	5.733	1.041	0.950
160	161.04	8.560	6.539	1.208	1.109
180	168.46	9.667	7.338	1.380	1.273
200	175.84	10.777	8.137	1.557	1.440
250	194.07	13.553	10.151	2.017	1.873
300	212.02	16.325	12.207	2.498	2.323
350	229.67	19.089	14.292	2.997	2.786
400	247.04	21.846	16.395	3.511	3.260
500	280.90	27.388	20.640	4.580	4.234
600	313.59	33.096	24.902	5.696	5.237
700	345.13	39.130	29.128	6.860	6.274
800	-	-	33.277	8.072	7.345
900	-	-	37.325	9.203	8.448
1000	-	-	41.269	10.503	9.585
1100	-	-	45.108	11.846	10.754
1200	-	-	48.828	13.224	11.947
1300	-	-	-	14.624	13.155
1400	-	-	-	16.035	14.368
1500	-	-	-	17.445	15.576
1600	-	-	-	18.842	16.771

°F = (1.8 x °C) + 32 **°K = 273.15 + °C**

Specifications

Model : Intelligent 11
No of channels : 08
Inputs : Pt - 100 / Thermocouple / 4-20 mA
Range : As per chart given below
Indication accuracy : +/- 0.25 % of FS +/- 1 digit
Least count : 0.1°C below 400 °C , 1 °C above 400 °C
Accuracy deviation due to
a) Temp. Variation : +/- 0.02 % / °C , ref at 25 °C
b) Supply Variation : +/- 0.01 % /V
Operating modes : Auto, Manual, Program.
Keyboard : 4 Keys Membrane keypad
Programming : Through keyboard (4 keys)
Display : Seven digit,12.5 mm seven segment Red LED
2 for channel no, 4 for parameter value and
1 for unit.
Memory : 3271 records stored in memory
Display time : 0 (skip) to 99 secs. user programmable.
Battery backup : Built in
Power supply : 230 V AC, +/- 10 % , 50 Hz
Ambient Temp. range : 0 to 55 °C
Sensor break ind. : Up scale [OPEn]
Ambient Compⁿ : Built in (for thermocouple inputs only)
Relative Humidity : 90 % Non Condensing
Power consumption : 6 VA
Cutout : 186 x 92 mm Depth : 160 mm

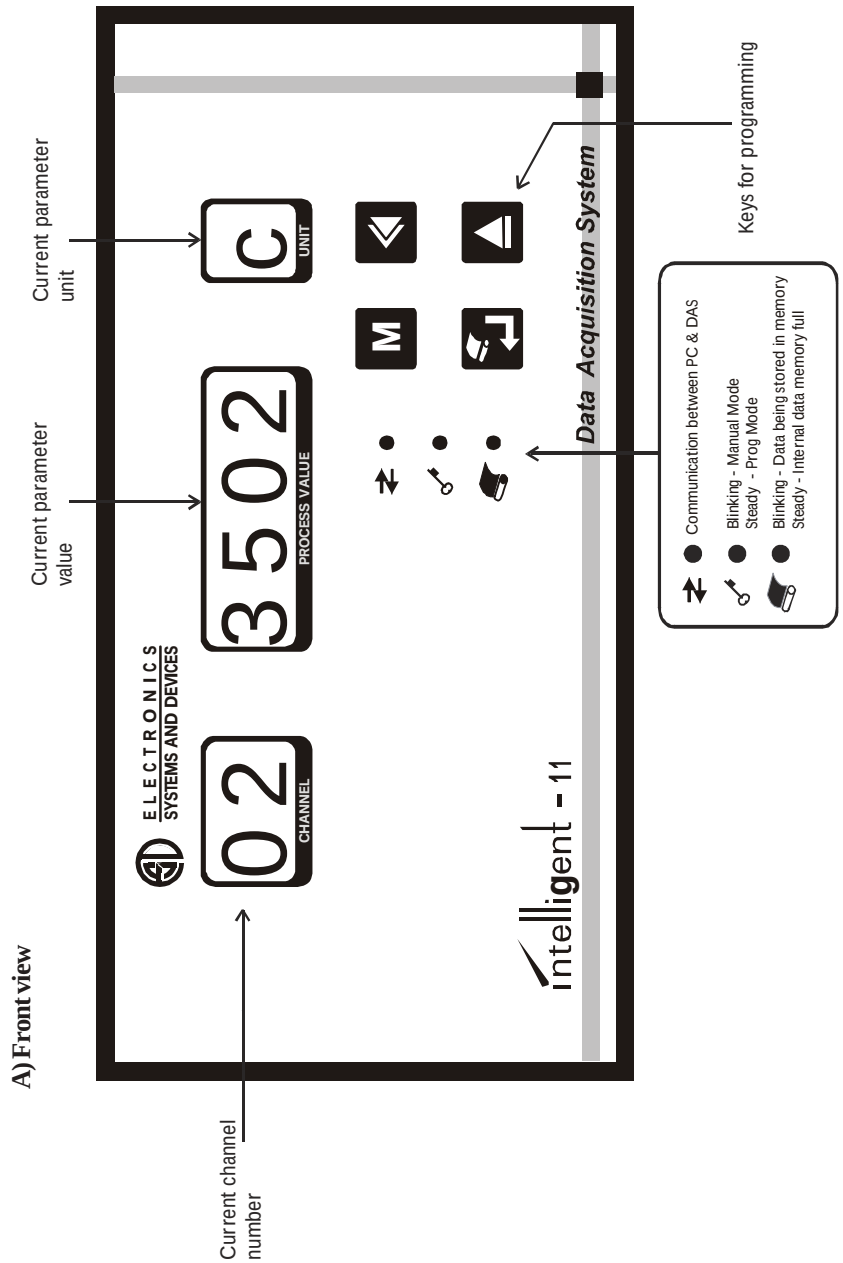
Output : RS 485 2 wire for communication
Serial Communication : Through RS 485 - RS 232 convertor
PC Software : Designed in .Net and suitable to run on
Win Xp and Win 2000 OS.

Ranges :

Input	Range (°C)
4 - 20 mA	0-100 % As reqd.
Pt - 100	-50 to 200, 0 to 400
Fe-Const	0 to 600

Input	Range (°C)
Cr - Al	0 to 1200
Pt - Pt. 13%Rh Pt - Pt. 10%Rh	0 to 1600

Illustrations



b) Thermocouple input

1. Remove the thermocouple from its terminals and connect a stable mV source in its place with proper polarity.

2. Feed ambient compensated mV corresponding to 20 % of FS. The display should show corresponding temperature. If the displayed temperature is incorrect turn the '**ZERO**' potentiometer to get correct reading on the display
   e.g: Ambient compensated mV for Cr - Al thermocouple for 200 °C at ambient temp 30 °C will be mV corresp. to 200 °C (8.137mV) minus mV corresp to 30°C (1.203mV)= 6.934 mV.

3. Feed ambient compensated mV corresponding to 80 % of FS. The display should show corresponding temperature. If displayed temperature is incorrect turn the potentiometer marked **'SPAN'** to get correct reading on the display.
   eg.: Ambient compensated mV for Cr - Al thermocouple for 800 °C at ambient temp 30 °Cwill be mV corresp. to 800°C (33.277mV) minus mV corresp to 30 °C (1.203mV) = 32.074 mV.

4. Repeat steps 2 and 3 till there is zero error at both calibration points.

Check the calibration of the instruments every six months. In case of error recalibrate using certified calibrators to ensure precise & accurate monitoring and control of process parameters.

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.

i. Remove the cover of the instrument, by removing the fixing screws at the back side of the instrument.

ii. Switch on the supply and allow 5 minutes for achieving thermal stability

Depending on type of sensor used proceed as follows:

a) Pt - 100 input

1. Remove the PT - 100 from its terminals and connect a resistance decade box in its place.

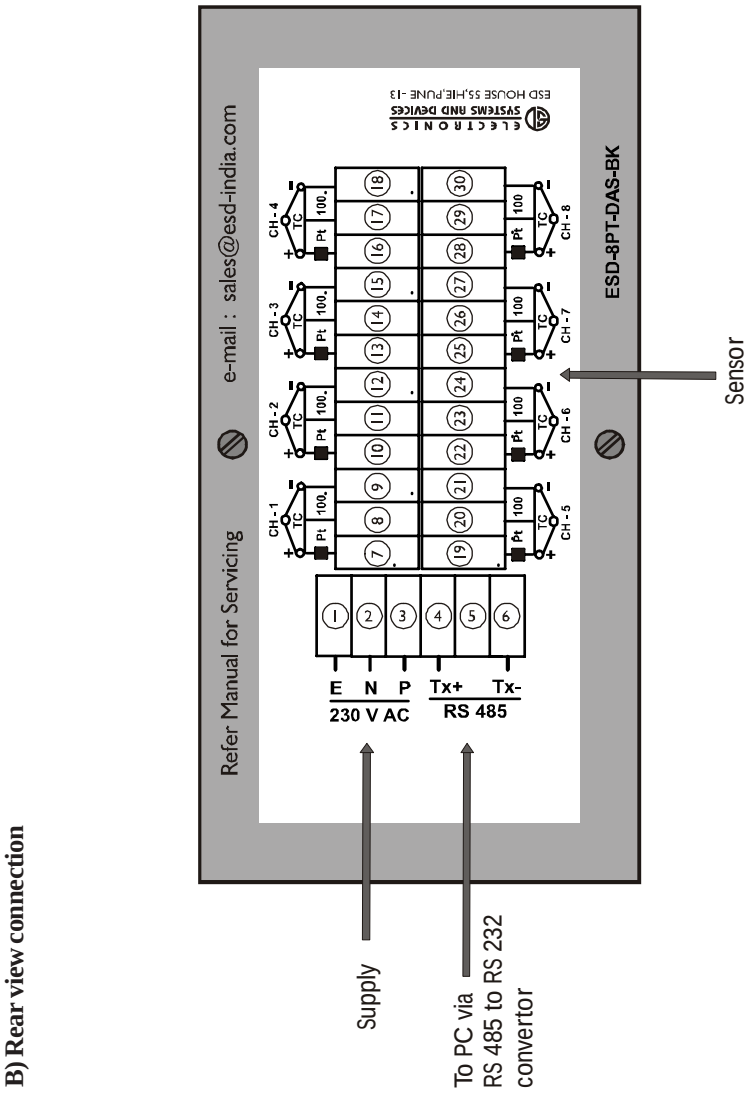
2. Feed resistance corresponding to 20 % value of entire range (e.g. resistance corresponding to 20 °C in 0 to 100 °C range) The display should show corresponding temperature. If the displayed temperature is incorrect, adjust the ZERO potentiometer for that channel marked as '*Channel no*' to get correct reading on the display.

3. Feed resistance corresponding to 80 % value of the entire range (e.g. resistance corresponding to 80 °C in 0 to 100°C range). The display should show corresponding temperature. If the displayed temperature is incorrect adjust the potentiometer marked 'SPAN' to get correct reading on the display.

4. Repeat steps 2 and 3 till there is no inter effect on one another.

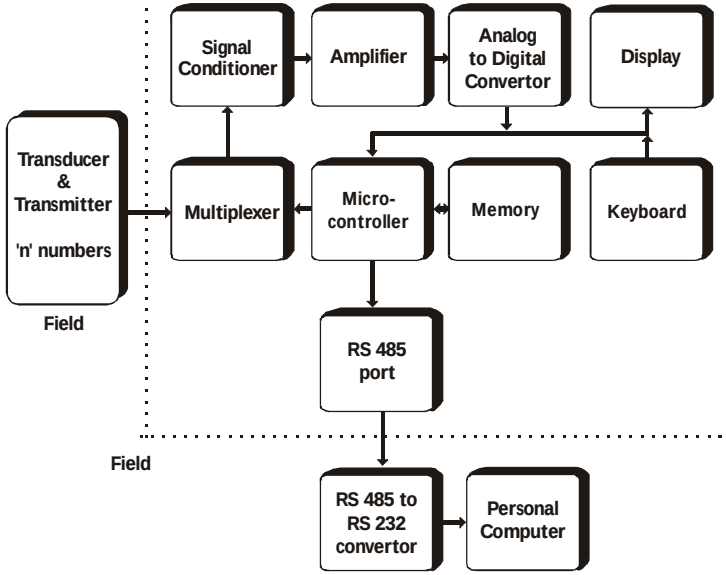
5. Repeat steps 1,2 and 3 for all remaining channels.

Illustrations



B) Rear view connection

Operation



Signal Conditioning

This circuit block takes input from the temperature sensors connected in the field and converts the recieved signals into appropriate levels for further processing. It consists of a simple bridge adjusted to give a mV o/p corresponding to the temperature sensed by the transducer, i.e. 0 mV at 0 °C, 100 mV at 100 °C etc.

Multiplexer

Since there are multiple analog inputs, they have to be processed individually. The multiplexer sequentially selects each input, connecting it to the further circuitry for a fixed time period, after which it swtiches the next input.

Analog to Digital Convertor

This block consists of the Analog to digital converter chip, and it's associated circuitry. It takes the analog signal from the previous stage and converts it to an equivalent digital signal. This digital value is then passed on to the main processor for further processing.

Installation Procedure for PC Software

1. Please insert the PC software installation CD provided along with the data logger into the CD drive of the computer.

2. After doing so, explore the CD. You will see four different folders having the names WINXP, WINXP Proff and WIN 2000. As per your operating system, select the folder and run the setup file from the folder.

3. The setup will guide you for installation of the PC software at a predefined location. The default location is c:\ program files \ Intelligent 11 folder. User has the choice to change this folder to his own choice at the time of setup installation.

4. After the setup is completed, user can run the software from the start menu/ program files / intelligent 11 / intelligent_11.exe file. User will be asked to enter the password which is "GOD" by default. This password is case sensitive and user can change it later on.

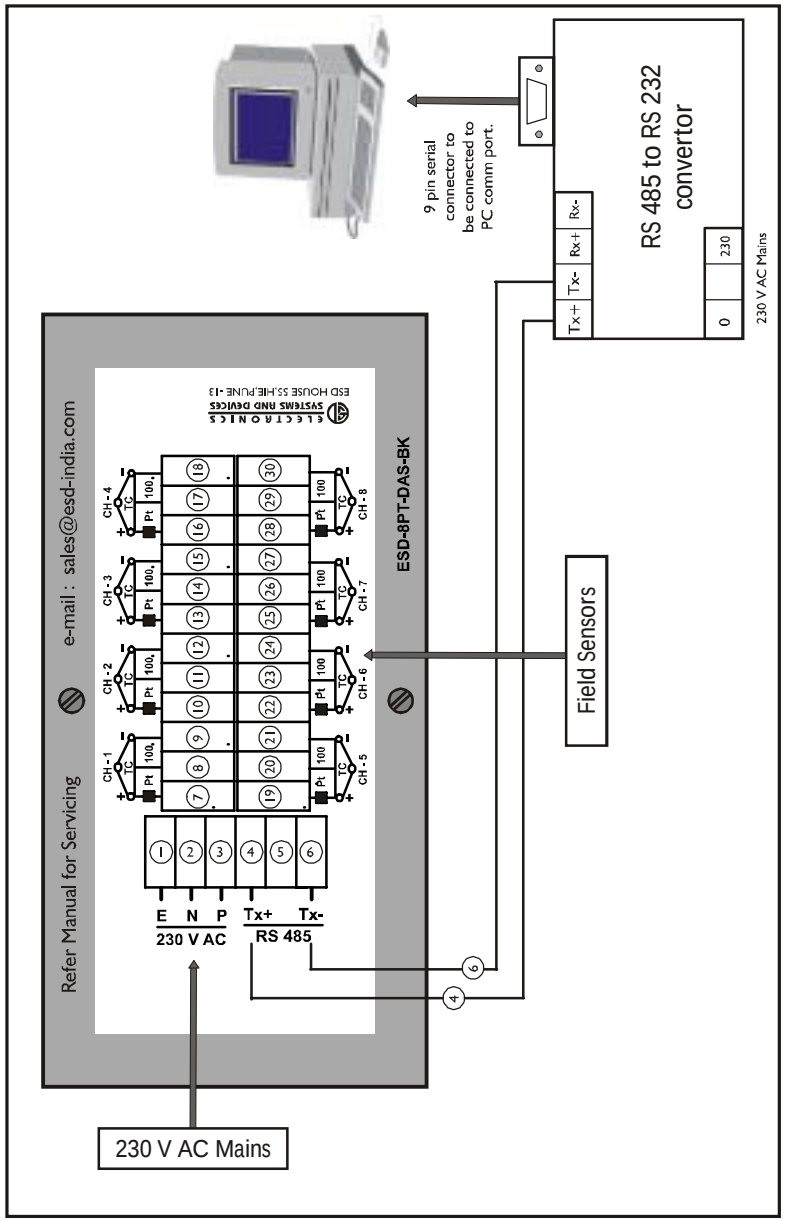
5. After this, user has to enter the file name by which he wants to save the data. This file iis saved in excel format and will be stored in the output folder at the location where the software is installed.

6. Ensure proper com port is selected and the serial data interface cable is connected to the computer.

7. Then from the data logger user needs to select the logging device as PC and initiate a print command (enter key in auto mode) to transfer all the data in the memory of the data logger to the PC. After the data transmission is complete, user can either clear the memory of the data logger or continue to store records ahead of the last stored record if the memory is not full.

8. Please remember that for online data transfer to the PC, the records stored in the memory of data logger should all be cleared.

System Connection Diagram



The Microcontroller

The microcontroller used in data logger is Intel's MCS 51 family's IC 8031. This is a 8 bit processor. This series of Intel is optimised for control applications and hence this microcontroller. This is the brain of the instrument and executes overall control on it. All functions of scanning the input signal via multiplexers, data processing, data monitoring, displaying, storage of data and ouput control are performed by the microcontroller.

Keyboard and Display

Bright seven segment displays are used to show parameter values and also to prompt messages to the user. Super bright LED's are used to indicate other parameters such as alarms, relay status, and mode of operation. The keyboard is a 4 key membrane keypad which gives good firm contact and a longer life. The user can program the DAS through this keypad.

Memory

The DAS has 2 separate needs for the memory

1. To hold the System Firmware
2. To hold the Program parameters of the DAS

The firmware resides in an EPROM, whereas the programme parameters are stored in a static RAMs.

RS 485 Port

This full duplex serial communication port gives the signals for serial communication when a serial transmission is initiated.

EXTERNAL DEVICES

RS 485 to RS 232 Convertor

This convertor converts the RS 485 signals received from the data logger to RS 232 signals suitable for the PC.

Personal Computer

A PC required to run the PC software and connected the output of RS 485 to RS 232 convertor. Basic requirements are :

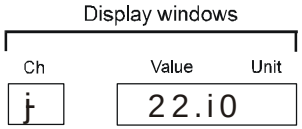
1. Pentium 3 or above processor with minimum 128Kb RAM
2. Operating System : WinXP, Win 2000

Installation Procedure

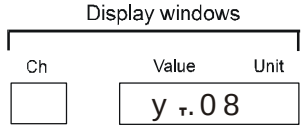
The instrument should be mounted in a place where it is clearly visible and accessible.

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. In case of Platinum Resistance bulb connect Red wire to the to the terminal with small resistance shown, Green wire to the next terminal & Black wire to the third terminal. The Black and Green wires are shorted and connected together at one end of the bulb inside the bulb head.
5. In case of thermocouple type instruments, connect the positive of the thermocouple to '+' terminal and negative of the thermo couple to '-' terminal.
6. Use correct type of compensating cables for thermocouple type instruments.
7. Ensure proper earthing to the instrument.
8. Connect the RS 485 2 wire connections to the RS 485 to RS 232 convertor.
9. Ensure supply is given to the RS 485 to RS 232 convertor
10. Connect the 9 pin serial cable provided from the RS 485 to RS 232 convertor to the serial port of the computer.
11. Ensure all the connections are as per System connection diagram.

This time is in 24 hours format. User can program the real time clock of the datalogger by using the increment and shift keys.When we press enter key, data logger displays datein the format as shown below.



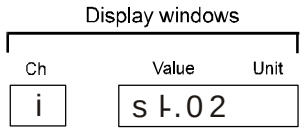
The user can modify the date over here. First date of the month and then month of the year is to be programmed. When we press enter key, data logger displays year in the format as shown below.



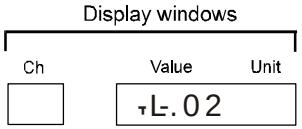
Here the user can set the year value.
With this the programming of the datalogger is complete. When the user presses enter key, the data logger go the auto mode and functions are per the program parameters..

If enter key is pressed now, the records stored in memory will be deleted. If user does not want to delete the previous records, press enter key when the message is at "DEL.NO".

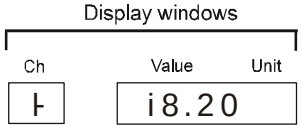
The data logger will now display the scan time of channel number 1 in the format given below.



This value is in seconds. This is the time for which data logger will display process value of channel number 1 in auto loop. Maximum limit for this value is 99 secs and we can also skip this by setting scan time as 0 secs. When we press enter key, data logger goes to scan time programming of channel number 2. Like this, use can program all the eight channels. After completing programming of channel no. 8, data logger displays the scan time of real time clock in the format given below.



This value is in seconds. This is the time for which data logger will display real time clock in auto loop. Maximum limit for this value is 99 secs and we can also skip this by setting scan time as 0 secs.
When we press enter key, data logger displays the real time clock in the format given below.



Modes Of Operation

The DAS works in 3 different modes viz Auto, Manual and Program mode.

Auto Mode

On POWER ON the DAS goes into AUTO mode. In this mode - starting from channel 1 - the instrument sequentially displays the process parameters of all channels in the following sequence,

Process Value (PI) of CH1
till .... Process Value (PI) of CH8
Real time (rt) 11.05

Each of these parameters is displayed for a fixed amount of time as programmed by the user and repeated sequentially.

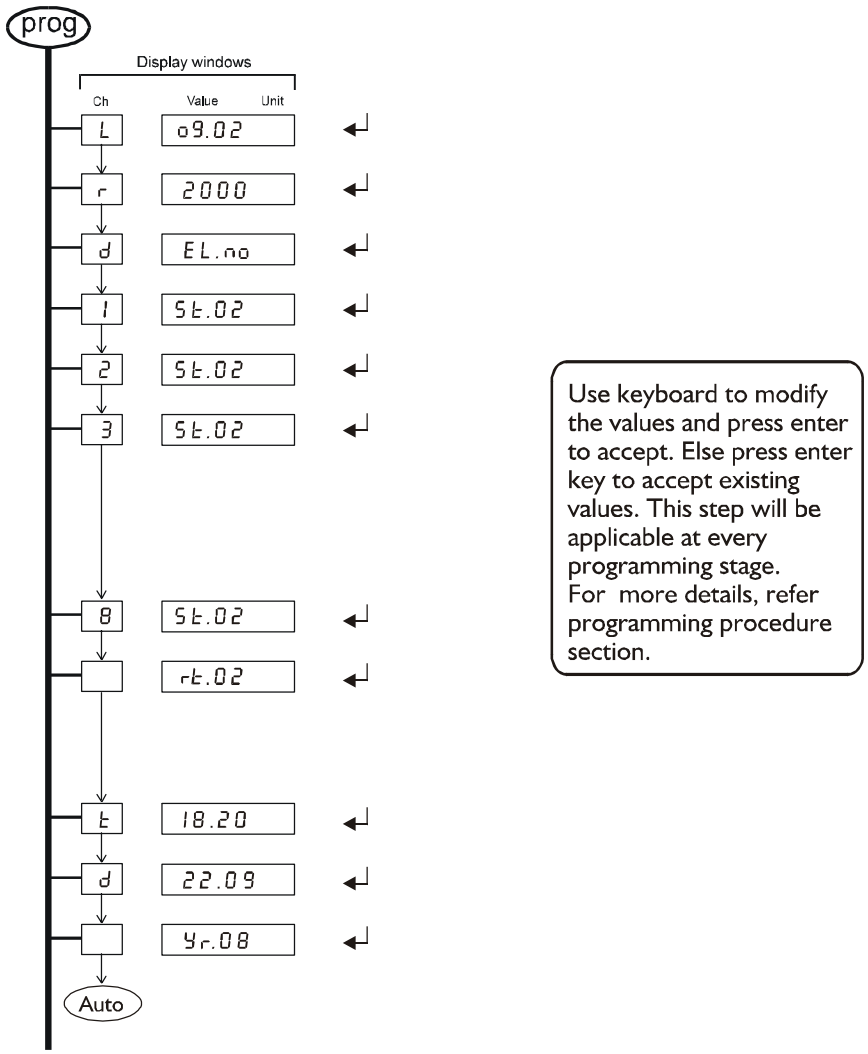
Manual Mode

When the instrument is in the Auto mode, pressing the function key will take the data logger to the manual mode. The manual mode is indicated by the steady ON of manual LED. The data logger will display the temperature of channel no. 1.
By increment key user can scroll from channel number 1 to channel number 8 and then real time. After real time DAS comes to channel no.1 The scanner will keep this display until the user goes to auto or programme mode.
Even in the manual mode, data logging continues as per the defined time interval.

Program Mode

The user can change any parameter of the data logger program only through the program mode. To start the program mode the user must go to the programme mode by pressing the function key in manual mode. During programming the PROG LED will be ON. Programming details are explained in the PROGRAMMING PROCEDURE section of this document. To exit the program mode user must press the function key.

Program Mode Flowchart



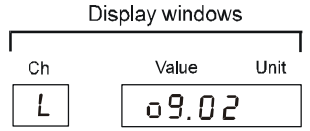
Use keyboard to modify the values and press enter to accept. Else press enter key to accept existing values. This step will be applicable at every programming stage. For more details, refer programming procedure section.

Note :

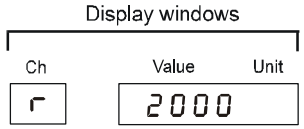
- Theincrement key are active only when a flashing cursor is being displayed

Programming Procedure

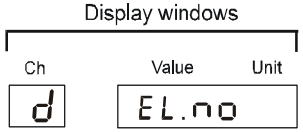
Start the PROG mode by pressing the function key in manual mode. The LED marked PROG will light up.
The data logger will display the logging time interval in the format given below.



This value is in minutes. The user sets here the time interval after which every record will be either stored in memory or transfered to the PC. When we press enter key, the data logger shows number of records stored in its memory in the following format.



The maximum number of records that can be stored in the memory is 3271. The blinking LED becomes steady when maximum number of records is r eached and now the data logger will not accept new records to be stored into its memory. When we press enter key, the data logger displays the following message.



If the user wants to delete the previous records stored in the memory, press the increment key. Following message will be displayed.