

FLOW INDICATOR TOTALISER MODEL: 1008S
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User's Manual

FLOW INDICATOR TOTALISER 1008S

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1. INTRODUCTION

This is a microcontroller based Indicator - Totaliser unit, with very high performance to price ratio. It is highly versatile, accurate and different from the conventional indicators.

1.1 TECHNICAL DETAILS:

The instrument is made in 96 x 96 x 110 mm size with DIN standard panel cutout of 92 x 92 mm.

Front is sealed membrane type to withstand dusty environment. On back plate detachable terminals are provided for easy connection.

The programming, calibration and operation of the instrument are by four simple keys and with two independent displays groups: one for flow rate and one for batch total. Operation of the instrument is menu driven with user understandable prompts. For protecting programmed data password protection facility is provided. Integrated total, batch total and roll count are cleared by special password.

The product is made to accept current (4-20 mA, 0-20mA), Voltage (1-5Volt, 0-5 Volt) input, pulse input & Digital input. It is available as a single input version only. The instrument is providing with the five-point calibration. The unit can be calibrated in installed condition itself by front panel keys at predefine points.

The set Parameters and integrated total are stored in serial NVRAM. No battery back up is required.

2. SPECIFICATIONS

2.1 Measured input signal:

- **Number of Inputs:** 1(one) with Optional 2 & 3
- **Input Type, Measurement Range & accuracy:** As per table 1
- **Sampling Period:** 15sps
Burn out detection: Available 1 to 5VDC, 4 to 20 mA, 0 to 10 KHz.
- **Input Resistance:**
250 Ohms Internal for current Input
320K Ohms for Voltage Input
- **Allowable signal source resistance:** DC input voltage: 1KΩ or less . Effect from allowable signal source Resistance: 0.031 % / 100 or less
- **Range :(Table-1)**

Note: Input type is factory set.

INPUT TYPE		RANGE	Accuracy
DC Voltage	1-5V	0 to 20000	± 0.25% of full scale ± 1 Count
	0-5V		
DC Current	4 to 20 mA		
	0 to 20 mA		
*Pulse input	0 to 10 Khz		
Integrated / Batch total.		0 - 99999999	**0.45 %

* Max. Pulse level ≤ 24V

Min. pulse level > 1.0V

** ±(0.45% of Reading + 1 Digit)

- **Allowable input Voltage:** DC voltage: ±20V DC
- **Noise Rejection Ratio:**
Common Mode: > 100db
Normal mode: > 40db
- **Response time:**

Input to relay o/p: < 1 second.

Input to Analog o/p: < 1

second or less, 63 % (10 - 90%)

maximum excursion when PV changes from 10% to 90%)

- **Resolution:** 16 bits
- **Polarity Protection:** Not Provided

2.2 Loop Power Supply:

24VDC \pm 5% @ 50mA

2.3 Calibration:

- Ambient, Zero and span adjusted by digital calibration through front panel Keys. One shot calibration of both input and output.

2.4 Retransmission Output:

- **Number of output points:** 1
- **Output Signal:** 4 to 20 mA DC
- **On load resistance:** 500 Ω or less
- **Output accuracy:** \pm 0.25% of full scale +1 count
- **Resolution:** 12 bits (5 μ A)

2.5 Contact Input (Digital input):

- **Usage:**
Input 1: Stop batch
Input 2: Integration total zero
 (Therefore Batch total & roll count will be zero)
Input 3: Start batch
Input 4: Batch total zero
- **Number of Inputs:** 4
- **Input type:** Non- voltage contact input or transistor open collector input
- **Input contact capacity:**
 12AVDC, 10mA or more
 (for non – voltage contact input)
- **On/ Off determination:**
For non-voltage contact input
 ON = contact resistance of 1K Ω or less,
 OFF = contact resistance of 20K Ω or more

(Time required for o/p to reach 63% of the

- **For transistor contact input**
 ON = 2V or less
 OFF = leak current of 100 μ A or less
- **Minimum retention time for status detection:** About 1 Second

2.6 Contact Output:

- **Usage:** Flow alarm & batch
- **Number of relay contact outputs:**
 4 (2 Flow alarm relays, 2 Batch relays)
- **Relay contact rating:**
 250VAC/5Amps
- **Relay contact terminal:** 3
 (NO, NC, Common)

2.7 Display Unit Specification:

- **Process Value display:** 0.56" 5 digit 7- segment red display
- **Integrated total display:** 0.40" 8 digit 7- segment red display
- **Parameter display:** Same integrated total display
- **Status indicating lamp:** Red LED's

2.8 Construction/Installation/Wiring:

- **Structure:**
 Front fascia IP54 complied (not certified), Enclosure GP (IP20).
- **Body construction:**
 Polycarbonate plastic.
- **Case color:** Dark grey
- **Weight:** 0.45Kg
- **Dimension:** 96 W* 96H*125D max behind panel with terminal (all in mm)
- **Mounting:** Panel mounting
- **Panel cut-out:**
 92W* 92H (all in mm)
- **Wiring:** 2.5sq.mm
- **Standard Accessories:**
 2 mounting clamp

2.9 Power supply/Isolation

- **Power supply:** 90 to 255VAC, 50Hz (Optional 24VDC)
- **Power consumption:** <10VA
- **Memory backup:** EEPROM

- **Withstanding voltage:**

Between primary terminal and secondary terminal 1500VAC for 1minute.

Between primary terminal and ground terminal 500VDC for 1minute.

Between ground terminal and Secondary terminal 500V AC for 1 minute.

(Primary terminal: Power supply, relay output)

(Secondary terminal: Analog input/output signal terminals, contact input terminal)

- **Isolation resistance:**
Between power supply terminal and ground terminal, 500VDC, 50MΩ.
- **Isolation Specification:**
Measured input terminal: Isolated from other input/output terminals. Not isolated from 24Vdc supply (Transmitter power supply) and internal circuit.

24V dc supply for Transmitter:

Not isolated from the measured input terminal & internal circuit, isolated from other input/output terminals.

Retransmission output terminal:

Isolated from other input/output terminals and internal circuit.

Contact input terminal: Isolated from other input/output terminals and internal circuit.

Relay Contact o/p terminal

(Digital input): Isolated from other input /output terminals and internal circuit.

RS-485 communication terminal:

Isolated from other input/output terminals and internal circuit.

Power supply terminal: Isolated from other input / output terminals and internal circuit.

Ground terminal: Isolated from other input/ output terminals and internal circuit.

2.10 Environmental conditions

- **Normal Operating conditions:**
Ambient Temperature: 0 to 55°C
Ambient humidity: 30 to 90% RH (non-condensing)
Warm up time: >10 Minute
- **Transit/storage conditions:**
Temperature: 0 to 70°C
Humidity: 30 to 90 % RH (non-Condensing)
- **Effect of operating conditions:**
Effect of ambient temperature:
For voltage input:
± 0.005% of FS/ °C or less
For analog output:
± 0.010% of FS/ °C or less

FUNCTIONAL SPECIFICATIONS

2.11 Alarm Function

- **Alarm types:** Flow high limit, Flow low limit,
- **Batching Alarm:** Pre warn and set point.
- **Setting Ranges for Process Value Alarms:**
Flow (PV) Alarms:
Min = Zero of individual I/P type mentioned in table1
Max = Span of individual I/P type mentioned in table1

2.12 Display and Operation function

- **PV display:** 5 digit red 7 segment display for flow rate

- **Integrated total:** 8 digit red 7 segment display for integrated total
- **Parameter display:** Same 8 digit red 7 segment display integrated total
- **Status display:** Red LEDs (for alarm & Batch)
- **Operation keys:**
 - ◀ /Start: to enter in to sub menu, select digit, start batch.
 - ▲ /stop: Increment value of selected digit, stop batch.
 - ⌂ (Set or Index) to enter in to configuration mode, calibration mode, program mode, scroll menu and save edited data.

2.13 Communication

- **Protocol:** Modbus RTU serial
- **Standard:** EIA RS-485
- **Max. Communication distance:** ≤ 1200 mtrs. (For 9600 bps RS 485)
- **Communication method:** 2 wire half duplex (RS 485)
- **Data frame:** N, 8, 1
- **Communication rate:** 9600, 19200 bps
- **Max. Connectable controllers/Indicator:** 32
- **Address range:** 1 to 99

2.14 Special function

- **Square root extraction:** Applicable
- **Digital filter:** Applicable
- **Time base unit:** Second, minute, hour, day
- **Conversion factor:** 0.00 to 99.99
- **Five point linearization:** Applicable
- **Pulse out put:**
 - Maximum pulse:** 20 pulses/Sec.
 - Excitation Voltage:** <24Vdc with maximum 10 mAdc
- **Low flow cut off:** Applicable

3. HARDWARE DESCRIPTION

The unit consists of a CPU, KB/Display card and Power Supply (SMPS)

3.1 CPU CARD:

The CPU card has necessary hardware for:

- Driving Thirteen(8+5) digit multiplexed Display
- Four key keypad interface.
- Watch_dog_circuit.
- ADS1110 circuit interface for input.
- DAC7571 circuit for current output.

The CPU card carries 5-pin & 4 pin, 5.08mm pitch and detachable Male connectors.

The connector is accessible from back panel cutout.

Matching female connectors are supplied along with the instrument.

The card is connected with KB/Display card and it is fitted with front & back plate.

3.2 KB / DISPLAY CARD AND FRONT PANEL:

A KB / Display card has two set of displays: 5-digit display for rate indication. (First group of displays)

8-digit display for totaliser. (Second group of displays)

Four keys are also mounted on this card. The card is connected with CPU card with 20-pin connector. The card is fitted with the bezel. An overlay is provided on the front side.

3.3 ENCLOSURE:

This is general purpose DIN standard Polycarbonate Plastic enclosure suitable for panel mounting. Panel mounting is to be done using side brackets.

3.4 POWER SUPPLY:

This is a Switch mode power supply. It accepts mains input ranging from 90-255 VAC.

It generates DC supply required for Logic & signal conditioning. It also generates +24VDC for transmitter.

The SMPS card carries a 3-pin, a 5 pin and a 2 pin, 5.08 mm pitch, detachable Male connectors.

The connectors are accessible from back panel cutout.

Matching female connectors are supplied along with the instrument.

3.5 RELAY CARD:

A Relay Card is connected between CPU card and SMPS card. It consists of 4 OMRON 12V DC relays mounted with the help of side PCBs.

The Relay card carries a 12-pin, 5.08 mm pitch, and detachable Male connector.

The connectors are accessible from back panel cutout.

Matching female connectors are supplied along with the instrument.

4. INSTALLATION GUIDE

Following steps should be followed for proper installation of the instrument.

- Unpack the instrument from the packing box carefully
- Mount the instrument in the panel cutout of 92mm x 92mm.
- Fix the instrument with the panel using two side brackets.
- All the electrical connections to be done at back panel on screw type terminals.
- Refer the Appendix for back panel connection.
- Make sure that no wire is connected loosely to avoid generation of spark and RFI. Before connecting the mains, check the mains configuration on the back panel.

- Ensure that the instrument is properly earthed.
- Check voltage between earth and neutral terminal. It should be less than 2 volts AC. If this voltage is greater then it results in unstable reading. In such a case use ISOLATION TRANSFORMER to provide mains to the instrument.

Table 2: Connection Details

N o.	Detail		No.	Detail	
1	Line	MAINS 95-255 VAC	17	C3	WP Relay
2	Neutral		18	NO3	
3	Earth		19	NC3	
4	DIN1+	Digital Inputs	20	C4	EP Relay
5	DIN2+		21	NO4	
6	DIN3+		22	NC4	
7	DIN4+		23	RxTx+	
8	DIN-	Pulse o/p	24	RxTx-	Serial I/F RS 485
9	POUT+		25	OUT+	
10	POUT-		26	OUT-	
11	C1	Low Alarm Relay	27	24VDC (GND)	4-20mA, 0-20mA 0-5v, 1-5v
12	NO1		28	I/P1+	
13	NC1		29	I/P1-	
14	C2	High Alarm Relay	30	Pulse I/p (0-10KHz)	
15	NO2		31	24V DC (50mA)	
16	NC2				

5. OPERATING DETAILS

The following paragraphs give detailed description of how to operate the unit. Before using the instrument, make sure to study and understand this section.

5.1 DISPLAY:

The unit has two windows/groups of display:

Upper:

Five digits 7-segment, 0.56" Red LED display:

It displays Flow rate/Process variable.

Lower:

Eight digits 7-segment 0.40" Red LED display:

In normal mode of operation, Batch total/Integration Total is displayed. While in EDIT mode, parameters are displayed in this window.

5.2 KEYBOARD:

Unit has 4 key membrane keypad organized as 4 x 1 matrix.

Following Table explain the Operation of the Keys used for configuration.

Table 3 Keyboard Details

Key	Function
SET (Index)	1. It will allow user to enter in EDIT mode, when instrument is in RUN mode. 2. It will scroll menu and submenu when it is enabled 3. It will save edited data.
(Decr)	1. It will enter into the submenu, when main menu is enabled and shows submenu's value. 2. It will select the digit to modify, when value is edited. 3. It will start batch, if pressed, when IT & BT are being displayed
← (Incr)	1. It will increment value of digit selected or constant selected. 2. It will stop batch, if pressed, when BT/IT are being displayed.
ESC (Cancel)	It will escape to previous status, with reference to its current status. Sequence of status: IT MENU SUB-MENU Parameter's Value Escape sequence When Esc key is pressed in Menu, the instrument will come in RUN Mode. If user wants to go in EDIT mode, he will have to enter the correct password again.

5.3 RUN MODE:

Whenever mains is switched on to the unit,

- Engineering value proportional to the input signal will be displayed as Process variable. Decimal point is displayed at selected position.
- Last saved batch total/integration total will be displayed on the lower window.

5.4 EDIT MODE:

In this mode user can verify or modify, various parameters.

To enter the EDIT mode, correct password is to be entered.

Password Protection:

When INDEX key is pressed, following prompt will be displayed at lower panel 7-segment display.

"bAt tot" , then
"Int tot" , then
"roL Cnt " , then
"PASSUord" .

User Can select the Parameter –any of the above prompt to display corresponding value by pressing INDEX key and then pressing "START KEY"(It is digit select key for editing the parameters),
At the selection of password, value "0000" is displayed.

Enter the correct password value with the help of START (digit select key) and STOP key (Incr key) and press INDEX KEY (INDEX key is used as ENTER key)

If correct password is entered & INDEX key is pressed, it will show the first mode PROG MOD. If wrong password is entered, then "0000" MSG will be displayed again at lower display window.

5.5 PARAMETER DESCRIPTION:

There are total three Menu Items:

Three parameters are displayed after entering correct password. These parameters related with totaliser are mentioned in the following table.

Table 4:Run Mode parameters Details

No.	Name	Description	Max digits	Limits
1	<u>Batch Total</u>	This parameter displays the Total flow since batch is started ('BT')	Max. 8	0 - 99999999
2	<u>Integrated Total</u>	This parameter displays the Total flow since Last Reset. ('IT')	Max. 8	0 - 99999999
3	<u>Roll Count</u>	This parameter displays the roll over count of the Integrated Total from '99999999' to '0' ('Rc')	Max. 4	0 - 9999

Batch total:

This is an eight digit totalized value, displayed as Batch total. As per the selected time base, Zero and Full-scale settings, this total is updated continuously, proportional to input. When New Batch Starts or Integration total is reset this value also gets initialized to 0.

1.	Program Mode
2.	Configuration Mode
3.	Calibration Mode

Integration total:

This is an eight digit totalized value, displayed as integrated total. As per the selected time base, Zero and Full-scale settings, this total is updated continuously, proportional to input.

Rollover Count (RC):

This is a two-digit value, displayed as the rollover that takes place when integrated total gets higher than higher limit. When the integrated total crosses high limit, this count is incremented by one.

So the total integration will be equal to **(Rollover Count) x (hi limit + 1) + Integrated Total (It)**

Integrated total, batch total and roll count are cleared by special password.

On power fail detection, current value of Batch total, integrated total and rollover count are stored in NVRAM.

Following section will describe the different Item of individual submenu.

5.5.1 Programme mode:

Programming menu provides facility to configure the relay for different function.

Table 5: Program Mode parameters Details

Low alarm and high alarm:

Value of Low alarm should be lower than that of high alarm. If user tries to set value of Low alarm **greater** than high alarm Value, error message will be displayed. Similarly, if user set value of High alarm **lower** than low alarm Value, error message will be displayed. Alarms value cannot be set greater than Full-scale Value (FS).

Comparison with Zero and full-scale:

Low Alarm value should be greater than Zero value. If user tries to set value of Low alarm less than Zero Value, error message will be displayed.

If (Low Alarm < Zero value), "error" message appears.

High-Alarm value should be greater than Full-scale value. . If user tries to set value of High-alarm greater than Full-scale value, error message will be displayed.

If (High Alarm > full-scale value), "error" message appears.

Set point and prewarn:

Error message will be displayed if, set point value is lower than pre-warn and vice versa.

Alarm ON-OFF :(submenu no 5 to 8):

Using these settings, user can set alarm/relay availability. If particular relay is set as 'yes', that particular alarm indication will be present over the display card and relay action will come into effect.

5.5.2 Configuration mode:**Batch Mode:**

If '*Batch Mode*' (Batch nod) is selected to 'Counter', then two parameters "*Batch count*" (Bat cnt) and "*No of Batches*" (No_of_bh) will be displayed in Configuration mode.

If '*Batch Mode*' is selected to 'Normal', then two parameters will not be displayed.

Input Type:

Based on requirement, user can select input type. It will be either Voltage or Current or Pulse.

Instrument Type:

If "*instrument type*" is set as indicator, then **Prewarn** and **Setpoint** parameter will not be displayed in Program mode.

Square root:

If user selects this mode as 'yes', flow rate will calculated using square root algorithm. Alternatively linear calculation will be done.

Digital Input:

No	Name	Description	No of digit	Lo limit	Hi limit
1	High Alarm	Alarm conditions for flow rate.	5	0	2000 0
2	Low Alarm		5	0	2000 0
3	Pre warn Alarm	Batch control values.	6	0	9999 99
4	Set Point Alarm		6	0	9999 99
5	Lo Alm Rly	Low alarm relay	-	Yes/No	
6	Hi Alm Rly	High alarm Relay	-	Yes/No	
7	Prewarn Rly	Prewarn Relay	-	Yes/No	
8	Set Pnt Rly	Set Point Relay	-	Yes/No	
9	Filter number		2	1	25

If *Digital input* is selected as 'yes' than only digital inputs will work. Four digital inputs are there.

DIN1+: Stop Function

DIN2+: Integration (Int tot) Zero (since IT is initialize to 0, therefore batch total/roll count are also initialized to 0)

DIN3+: Start Function

DIN4+: Batch total (bat tot) Zero

DIN-: GND (12V GND)

When any of these inputs is connected to DIN-, it will perform its specific function.

Digital Filter:

If *Digital filter* is selected as 'yes' than in programming mode user can see '*filter no*' parameter. If selected 'no' then '*filter no*' will no be displayed.

Time base: Time base is used for calculation & display of flow rate.

Table 6: Time base Setting details

Value of Integrated total for time period of t (in seconds) will be

Select	Time base	Divisor
0	Second	1
1	Minute	60 (1 x 60)
2	Hour	3600 (60 x 60)
3	Day	86400 (24 x 60 x 60)

Integration total= (flow rate * time't" in seconds)/divisor

Table 7: Configuration Mode Parameters

Sr. No.	Name	Description	No Of Digit	Lo Limit	Hi Limit
1	Batch Mode	Type Of Mode, For Flow Control	-	Normal, Counter	
2	Input Type	Type Of Input	-	0-5v, 1-5v, 0-20ma, 4-20ma, Pulse	
3	Type Of Instrument	Type Of Instrument, Which You Want To Use.	-	Indicator/ Totaliser	
4	Square Root	Mode Of Linearization	-	Yes/No	
5	Digital Input	To Be Used To Reset Batch Total, Integration total & to start batch and to stop batch	-	Yes/No	
6	Digital Filter	If Yes Than In Programming Mode It Will Show Filter No.	-	Yes/No	
7	Time Base	For Calculation/Display Of Flow Rate	-	Sec, Min, Hour, Day	
8	ZR1	Zero Value	5	00000	20000
9	FS1	Full Scale Value	5	00000	20000
10	No Of Batches		2	00	99
11	Batch Count	Counter Will Count How Much Batches Has Been Taken	2	00	99
12	Relay Mode	Two Type Of Mode	-	Normal, Failsafe	
13	Cut Off		3	000	100
14	DP	Decimal Point	-	0,0.1,0.01,0.001	
15	SF1	Full Scale For Segment 1	6	00000	20000
16	FL1	% Age Of Full Scale (Segment 1)	-	10,20,30,40,50,60,70,80,90,100	
17	SF2	Full Scale For Segment 2	6	00000	20000
18	FL2	% Age Of Full Scale (Segment 2)	-	10,20,30,40,50,60,70,80,90,100	
19	SF3	Full Scale For Segment 3	6	00000	20000
20	FL3	% Age Of Full Scale (Segment 3)	-	10,20,30,40,50,60,70,80,90,100	
21	SF4	Full Scale For Segment 4	6	00000	20000
22	FL4	% Age Of Full Scale (Segment 4)	-	10,20,30,40,50,60,70,80,90,100	

23	SF5	Full Scale For Segment 5	6	00000	20000
24	FL5	% Age Of Full Scale (Segment 5)	-	10,20,30,40,50,60,70,80,90,100	
25	Baud Rate		-	9600,19200	
26	Serial No		2	01 TO 99	
27	Pout		4	0001 TO 9999	
28	Default Display		-	Batch Total/Integration Total (Bat Tot/Int Tot)	
29	Pass		4	0000-9999	
30	Conversion Factor		4	00.00-99.99	
31	Clear Total	To Clear Integration /Batch Total And Roll Count	4	"PASS" & 0000-9999	

Batch counter and no of batches:

These parameters will be displayed only if the 'Batchmode' is selected to Counter type.

No of batches: Set the parameter according to the requirement. It decides how much batches are to be taken

Batch counter: It will be incremented by 1 whenever a new batch is started by START key in run mode. When batch counter value becomes equals to 'no of batches' value, then it will not *start* new batch.

Note: To reset batch counter, Enter in batch count (bat cnt) parameter in configuration mode. Press "Start" key to see its value. Now if user presses "Stop" key Batch counter value will be cleared to 0.

Relay-mode:

In 'Relay-mode' (relay nod), if set to 'normal' mode then alarm relays and LEDs will work according to alarm values.

i.e. Relays on, LEDs on
Relays off, LEDs off

But if set to 'Failsafe' Mode then alarm relays and LEDs will operate reversibly.

i.e. Relays on, LEDs off
Relays off, LEDs on

Cut off: (Low flow cut-off)

Cut off could be set to 0000 to 0100.

Cut off will display the % value.

Cutoff value = Cutoff parameter (in %) * Full scale value

If full scale value is 10000 and cut off is 5%

Then cut off value will be calculated as

$$= (5/100) * 10000 = 500.$$

So, if the displayed flow rate (displayed at upper window) is less than 500, it will not be added in integration.

Decimal Point Selection:

Decimal point selection will be given from the configuration mode.

Select	Decimal position
0	No decimal
0.1	One decimal
0.01	Two decimals
0.001	Three decimals

Five point Linearization:

This instrument has feature of five-point linearization. User can define up-to five different segments of the full-scale input (in percentage) with Full-scale engineering value for each segment. We have to program the value of flow rate at different inputs.

Here we are defining five scale factors for the current input 4 mA to 20mA. Let's have one example to understand this concept.

For Example:

ZR = 00000 and FS = 10000, Let us assume the Unit is current input mode.

Table 8 Five Point Linearization

In above example

Flow rate on Display varies between:

- 0 – 2000 for input of 0 % – 10%
- 2000 – 4000 for input of 10% – 50%
- 4000 – 4500 for input of 50 % – 60%
- 4500 – 7500 for input of 60 % – 80%
- 7500– 10000 for input of 80 % – 100%

If user wants a flow to be linear through out the span than configure this parameter as: SF1 = FS1, FL1 = 100 %.

User is not required to initialize SF2, SF3, SF4, SF5, FL2, FL3, FL4 and FL5.

Pout Selection:

Pout value decides the pulse Output.

There will be a pulse at pulse output pins (PIN NO.9, PIN NO 10), whenever a integrated total value is greater than by POUT by previous IT value [where last pulse is registered], it will be added to the integration total value.

i.e.

Current IT value \geq (Pout + previous IT value).

Example:

1. If Flow rate = 1000, Pout = 1000, Time base = second, Every second, 1000 is added in integration total. Since pout is 1000, 1 times of pout value is added to integration-total every sec. Therefore we will have 1 pulse/sec.

2. Flow rate = 1000, Pout = 100, Time base = second, Every second, 1000 is added in integration total. Since pout is 100, 10 times of pout value is added to integration-total every

sec. Therefore we will have 10pulses/sec. It could not be observed on CRO. For this use a pulse counters for testing.

3. Flow rate = 600, Pout = 10,

No	Flow rate	Value	Parameter	Display Value	Input Current mA
1	FL1	10%	SF1	2000	5.6
2	FL2	50%	SF2	4000	12.0
3	FL3	60%	SF3	4500	13.6
4	FL4	80%	SF4	7500	16.6
5	FL5	100%	SF5	10000	20

Time base = min,

Every second, 10(600/60) is added in integration total. Since pout is 10, 1 times of pout value is added to integration-total every sec. Therefore we will have 1pulse/sec or 60 pulses/min.

4. Flow rate = 600, Pout = 100,

Time base = min,

Every second, 10(600/60) is added in integration total. Since pout is 100, 1/10 times of pout value is added to integration-total every sec. Therefore we will have 1 pulse/10 sec or 6 pulses/min.

Default Display: This parameter will select the parameter to be displayed in run mode. If Int tot / Bat tot is selected then in run mode 'Integration total' / 'Batch total' will be displayed on lower panel accordingly.

If "instrument type" parameter is set as indicator, then this parameter will not be displayed in Configuration mode and Integration total will be displayed in run mode.

Password: A 'PASS' parameter is added in configuration mode. But it will always show '0000'. User has to remember the password.

If user needs to change password, then go in 'pass' parameter, enter the required password and press Enter key.

For eg: If user enters '1234' in '**pass**' parameter, then, to enter in EDIT mode, a password '1234' is to be entered.

Conversion Factor (Conv-F):

It is a constant, which simply divides process value by the factor set. Usually, it is set as 1.00

For example, if process value is 100 liters/minute & conversion factor is 1 then it will simply integrate process value as it is.

If we change conversion factor = 2, then it will divide process value by that factor i.e. $100/2 = 50$ & it integrates that value (in

No	Setting	Description	No of digit	Lo limit	Hi limit
1	Cal Zero	Zero Cal. Count	4		
2	Cal Span	Span Cal. Count	5		
3	Out Zero	Zero Cal. Count for Output	4	0000	4095
4	Out Span	Span Cal Count for Output	5	0000	4095
5	Default Out	If user selects 'yes', then Outzero = 800 and Out span (4000) is selected.	Yes/No		

both integral and batch total) but on the display it shows original process value.

Clear total:

Parameter to reset IT, BT, and RC.

If user enters the correct password, IT, BT and Roll over count gets cleared (initialized to Zero). And 'cleared' message is displayed on the lower window of display. By pressing ESC key, menu goes back to the clear total. If wrong password is entered, 'cleared' message will not appear.

5.5.3 Calibration mode:

Table 9: Calibration Mode Parameters Details

This menu allows user to perform calibration of analog input & output.

INDICATION:

For conversion in engineering value, the input is scaled between Zero and Full scale set values as per following formula (for linear mode):

For any type of input:

Indication (Engineering Value)

$$= \frac{X}{(\text{CALS} - \text{CALZ})} + \text{Zero}$$

$X = (\text{Input signal} - \text{CALZ}) * (\text{Full scale} - \text{Zero})$

CALZ = Value of input applied during zero calibration

CALS = Value of input applied during Span calibration

If input signal is outside the set Zero and Full-scale limit, all the four digits of the Process variable starts flashing. Only when input signal comes back into the allowed range, display becomes steady.

NOTE:

- 1). When no input is connected to the unit, it will display "open" message in pulse mode, current mode and voltage mode. (Pulse input 0 to 10Khz, 4-20mA, 1-5V)
- 2). When input is out of the range the display will blink.

6. Calibration Procedure:

Input Calibration:

As explained earlier, One can do calibration thro' the keyboard itself, Zero and Full-scale values are stored in NVRAM.

1. Switch on the instrument and allow 15 minutes of warm up time before starting calibration.
2. Take a standard source. Set it's output at desired Zero value. Apply output of the source to the input terminals of connector pin according to input select.
3. In calibration mode, Press shift /start key to calibrate zero. This will show prompt - "CAL Zr1". To enter in "CAL Zr1" mode press shift /start key
4. Lower window displays a count. This is raw count proportional to analog input. Wait till counts are stable, save this count by pressing 'Index' key twice.
5. Press ESC key to come out from "CAL Zr1".
6. Now apply input equal to Full scale/Span (CAL S):
7. Set output of the source at desired full-scale value. Apply output of the source to the input terminals
8. Press index key to go to calibration span. This will show prompt -"CAL SPn1". To enter in "CAL SPn1" mode press shift /start key.
9. Lower window displays raw counts count proportional to analog input.
10. Allow the reading to settle and Press 'Index' Key twice to save the count.
11. This reading will be stored as Span Now the instrument is calibrated.
12. Press ESC key to come out from "CAL SPn1".

Output Calibration:

For output calibration, measuring instrument should be at least 3 times accurate.

Out zero and Out span:

These two parameter are used for the calibration of re-transmission output. Users have to change the value of out zero and out span for the zero setting (for 4mA) and

span setting (20 mA) respectively for re-transmission out put.

13. In calibration mode, go to out zero calibration mode by pressing index key. This will show "oUT ZErO" prompt. To enter in "oUT ZErO" mode press shift /start key
14. Lower window displays a count. Using shift /start or inc/stop key to set reading (zero output) of connected ampere meter at output, exactly at 4.000mA and press index key to store the calibration value.
15. Press ESC key to come out from "oUT Zero".
16. Press index key to go to out span calibration. This will show prompt-"oUT SPAn". To enter in "oUT SPAn" mode press shift /start key
17. Lower window displays a count. Using shift /start or inc/stop key to set reading (span output) of connected ampere meter at output, exactly at 20.000mA and press index key to store the calibration value.
18. Press ESC key to come out from "oUT SPAn".
19. This reading will be stored. Now the instrument is calibrated.

If user enters values greater than 4095 "error" message will appear.

If user enters **out zero value > out span** value then also "error" message will appear.

Accuracy of retransmission O/p -
0.25% of Full span.

7. Start & Stop function:(In Run Mode)

START key:

If this key pressed batching relays (WP/EP) gets ON & BATCH TOTAL = 0. It means a new batch is started. If START key is

pressed again and again, it will not start the batch until WP/EP relays gets OFF .

Relays get OFF by two ways:

1. STOP key
2. BATCH TOTAL crosses the value of SETPOINT.

STOP key:

If user presses **STOP** key in running batch, batching relays (WP/EP) gets off. If again **STOP** key is pressed again and again only batching relays gets ON/OFF (only if BATCH TOTAL < (WP/EP) values. No new batch will be started by **STOP** key. When batch total

value crosses the WP/EP value, relays gets OFF and batch is over.

Again if START key is pressed then a new batch will start making BATCH TOTAL = 0. Batching relays gets ON.

8. MODBUS protocol

Here we will Two-function code:

Function code:

- 03h: for reading analog parameter value.
- 06h: for writing analog parameter value.
- 01h: for reading digital parameter value.
- 05h: for writing digital parameter value.

Command message consist of 4 fields as shown below.

Command message.

Station no
Function code +80H
Error code
Error check (crc-16)

Here master will send command to the slave and slave will response to the master if its unit no. Matches with command message's station no. Field.

To a relevant message, slave station creates and sends back a response

message, which corresponds to the command message.

If the content of the command message have any abnormality (for example, non actual function code is designated) other than transmission error, slave does not execute that command but creates and sends back a response at error detection.

The composition of error message at error detection is shown below.

Error message:

Station no (1 byte).
Function code (1 byte)
Data (4 byte)
Crc (2 byte)

Error code:

- 01H: illegal function
- 02H: illegal data address
- 03H: illegal data value.
- 08H: crc error.

Here slave will first check crc, if crc is o.k. it will assume that there is no transmission error. And if crc is not matched with crc calculated by slave station, slave station will send back error message with error code 08H. After crc slave will check unit no. If it matches with its own unit no, it will go ahead with command. Otherwise it will neglect the command.

Note:

For Analog Read:

FLx (FL1, FL2, FL3, FL4, and FL5) consists of 9 selectable values from 10 to 100.

For 10 it will read.... 0

For 20 it will read.... 1

If FL1 =100, Hex address 0x0024 will show 9.

For Digital Read/Write: Cmd Action = 1;
Reg. Address = 0x0001 to 0x0004.

1. Relays will read 0- OFF (relay) 1 – ON
2. For start /stop function
Cmd Action = 5
Reg Address = 0x0005

For Start – write 1
For Stop – write 0

Table 10 Modbus Registers Details

Sr.No.	Reg.No.	Parameter Name	Length in bytes (Words)	Read/Write
1	40001	High alarm	2(1)	R/W
2	40002	Low alarm	2(1)	R/W
3	40003	Setpoint	2(1)	R/W
4	40004	Setpoint+2	2(1)	R/W
5	40005	Prewarn	2(1)	R/W
6	40006	Prewarn+2	2(1)	R/W
7	40007	Conv-Factor	2(1)	R/W (00.00-99.99)
8	40008	Filter no	2(1)	R/W (1 to 25)
9	40009	Batch mode	2(1)	R/W (0 for Normal, 1 for Counter)
10	40010	Type of input	2(1)	R/W (0 for 0-5V, 1 for 1-5V, 2 for 0-20mA, 3 for 4-20mA, 4 for pulse)
11	40011	Type of Inst	2(1)	R/W (0 for indicator, 1 for Totalizer)
12	40012	Sqrt mode	2(1)	R/W (0 for Yes, 1 for No)
13	40013	Digital input	2(1)	R/W (0 for Yes, 1 for No)
14	40014	Digital filter	2(1)	R/W (0 for Yes, 1 for No)
15	40015	Time base	2(1)	R/W (0 for SECOND, 1 for MINUTE, 2 for HOUR, 3 for DAY)
16	40016	ZR	2(1)	R/W
17	40017	FS	2(1)	R/W
18	40018	No of batches	2(1)	R/W
19	40019	Batch counter	2(1)	Read only
20	40020	Relay mode	2(1)	R/W (0 for normal, 1 for failsafe)
21	40021	Cut-off	2(1)	R/W (000.0 to 100.0)
22	40022	Dp	2(1)	R/W (0 for 0, 1 for 0.1, 2 for 0.01, 3 for 0.001)
23	40023	SF1	2(1)	R/W (0-20000)
24	40024	FL1	2(1)	R/W (0-9)*
25	40025	SF2	2(1)	R/W (0-20000)
26	40026	FL2	2(1)	R/W (0-9)*
27	40027	SF3	2(1)	R/W (0-20000)
28	40028	FL3	2(1)	R/W (0-9)*
29	40029	SF4	2(1)	R/W (0-20000)
30	40030	FL4	2(1)	R/W (0-9)*
31	40031	SF5	2(1)	R/W (0-20000)
32	40032	FL5	2(1)	R (9)
33	40033	Baud rate	2(1)	R/W (0 for 9600, 1 for 19200)

Sr. No.	Reg.No.	Parameter	Length in byte (Word)	Read/Write
34	40034	Serial no	2(1)	R/W (01 - 99)
35	40035	Pout	2(1)	R/W (0000-9999)
36	40036	Default display	2(1)	R/W (0 for batch total, 1 for integration total)
37	40037	Out zero	2(1)	R/W (0000-4095)
38	40038	Out span	2(1)	R/W (0000-4095)
39	40039	Default out	2(1)	R/W (0 for yes, 1 for no)
40	40040	Int total	2(1)	Read only
41	40041	Int total+2	2(1)	Read only
42	40042	Batch total	2(1)	Read only
43	40043	Batch total+2	2(1)	Read only
44	40044	Roll count	2(1)	Read only
45	40045	Flow rate	2(1)	Read only
46	1	Set point relay	1	R, digital
47	2	Prewarn relay	1	R, digital
48	3	High alarm relay	1	R, digital
49	4	Low alarm relay	1	R, digital
50	5	Stop batch	0000	W, digital
51	5	Start batch	FF00	W, digital

*** For FL1 to FL4:**

To write these parameters:

0 for 10, 5 for 60,

1 for 20, 6 for 70,

2 for 30, 7 for 80,

3 for 40, 8 for 90,

4 for 50, 9 for 100

9. ORDERING CODE

Input type		Digital i/p		Communication		Mounting		Auxiliary o/p		
				X		XX		X	X	X
C	4-20mA	N	None	N	None	PO	Panel	Flow relay	Batch relay	Retx
D	0-20mA	Y	Yes	2	RS-485	W1	Wall-IP55	N	N	N
E	1-5VDC					FP	Wall-FLP	N	N	Y
F	0-5VDC							N	Y	N
G	0-10VDC							Y	N	N
N	0-10Khz(LO level)							N	Y	Y
P	0-10Khz(High level)							Y	N	Y
S	Special (Consult Factory)							Y	Y	N

X- Specify from the table
Y- yes
N- NO