

UNIVERSAL INPUT 5 ½ DIGIT PROCESS INDICATOR

Model : PI 541A

INSTRUCTION MANUAL

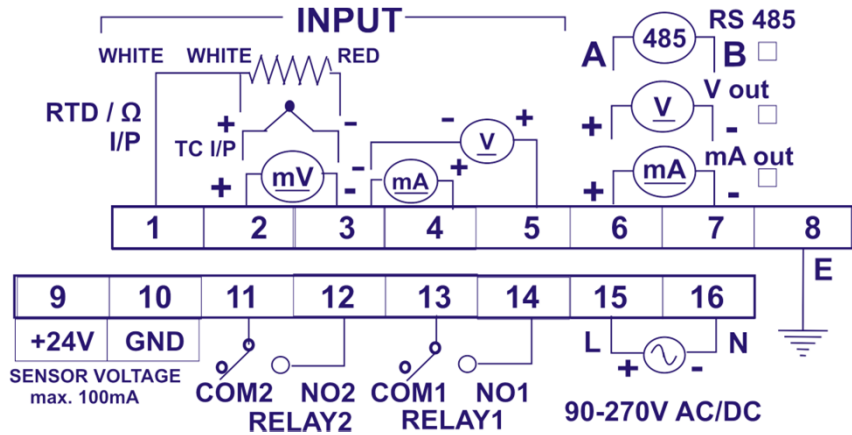
1. SPECIFICATION

Model	PI 541A
Display	5 ½ Digit 0.5 " 7 segment RED LED
Password Access	Provided for user & supervisory settings
Temperature Inputs (selectable)	RTD - PT 100 & PT 1000 Thermocouples - J, K, R, S, T, B, N, E
Analog Inputs	mA , mV , Volt , Ohms (selectable)
Input & Display Ranges for Temp. Inputs(scalable)	RTD - PT 100 - (-199.99 to 850.00°C / -327.8 to 1562.0°F)
	RTD - PT 1000 - (-50.0 to 400.0°C / -58.0 to 752.0°F)
	TC - J - (-200.0 to 1200.0°C / -328.0 to 2192.0°F)
	TC - K - (-200.0 to 1372.0°C / -327.8 to 2501.6°F)
	TC - R - (-40.0 to 1768.0°C / -40.0 to 3214.4°F)
	TC - S - (-40.0 to 1768.0°C / -40.0 to 3214.4°F)
	TC - T - (-200.0 to 400.0°C / -328.0 to 752.0°F)
	TC - B - (300.0 to 1820.0°C / 572.0 to 3308.0°F)
	TC - N - (-200.0 to 1300.0°C / -327.8 to 2372.0°F)
	TC - E - (-200.0 to 1000.0°C / -327.8 to 1832.0°F)
Input Ranges	0 to 20 mA / 0 to + 75 mV / 0 to + 10 Volt / 0 to 4000 Ω
Display Range for Analog Inputs	-199999 to + 200000 (± 2 lakhs counts) (scalable)
Temp. Input Resolution	1 , 0.1 , 0.01 (selectable)
Analog Input Resolution	1 , 0.1 , 0.01, 0.001 , 0.0001 , 0.00001 (selectable)
Units for Temp. Input	°C / °F (selectable)
Relay Output	2 Relay (5 A Rated)
Sensor Supply Output	24 V DC ± 10 % / 100mA Max. Load
Relay Status	High, Low, High Low, Band for each Relay (selectable)
Relay Set point	High & Low Set point for each Relay (selectable)
Relay Cyclic Delay	0 to 250 sec for each Relay (selectable)
Relay Hysteresis	0 to 10000 counts for each Relay (selectable)
Analog Output * (optional against order)	Galvanically Isolated 4 - 20 mA (or) 0 - 10 V O/P
PC Communication **	RS 485 (2 wire)(optional against order)
PC software(optional)	Provided with logging, Alarm Setup, Record, Graph
Protocol(optional)	MODBUS RTU
Slave ID	1 to 32 (selectable)
Baud Rate(bps)	9600 , 19200 , 57600 , 115200 (selectable)
Mounting	Panel Mounting
Over all Dimension	96 x 48 x 110 (W x H x D) mm
Cut out Dimension	92 x 44(W x H) mm
Operating Environment	0 to 50°C / 20 to 95 % RH non condensing
Power Supply	90 to 270 V AC/DC 50Hz
Weight (Approx.)	350 g

NOTE :

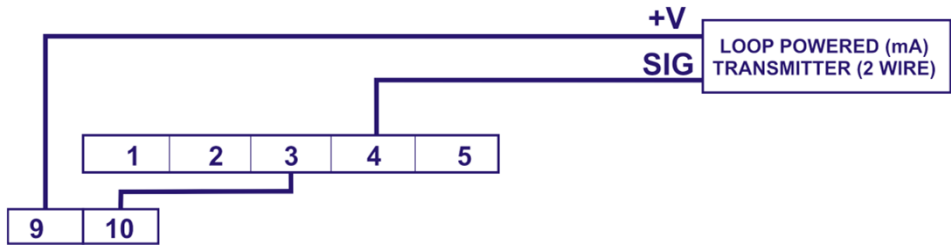
1. * & ** Analog Retransmission Output or RS 485 PC communication any one is possible in one PI 541A.
2. Due to continuous improvements, Published specifications may change without notice

2. CONNECTION DETAILS

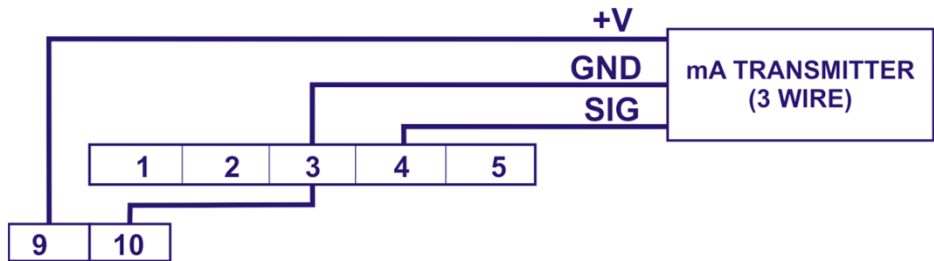


3. WIRING DETAILS

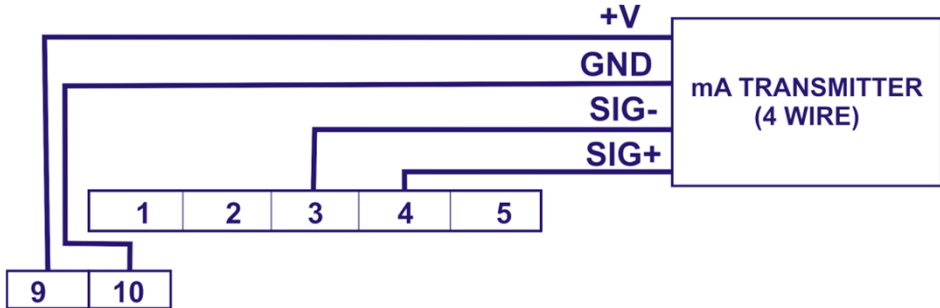
3.1. LOOP POWERED (mA) TRANSMITTER (2 wire)



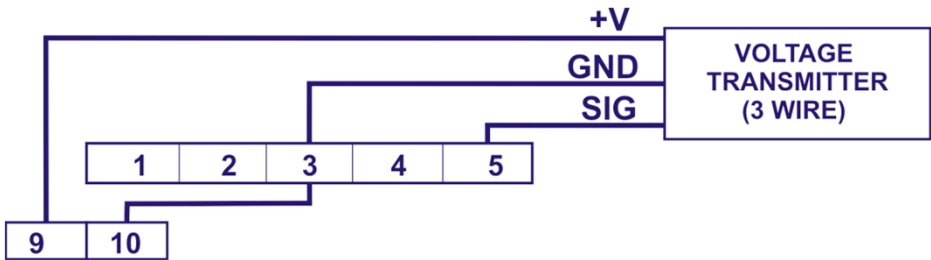
3.2. CURRENT(mA) TRANSMITTER (3 wire)



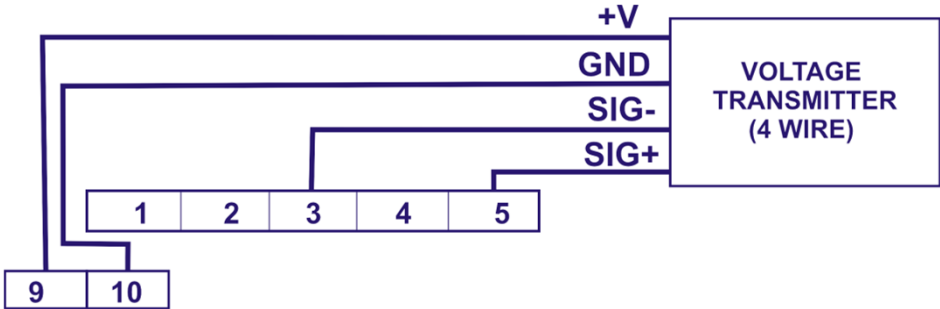
3.3. CURRENT(mA) TRANSMITTER (4 wire)



3.4. VOLTAGE TRANSMITTER (3 wire)



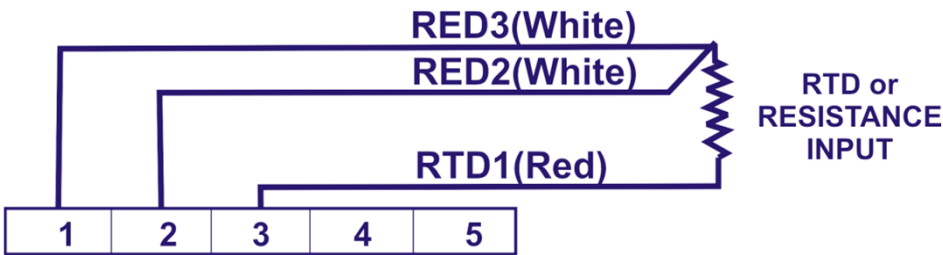
3.5. VOLTAGE TRANSMITTER (4 wire)



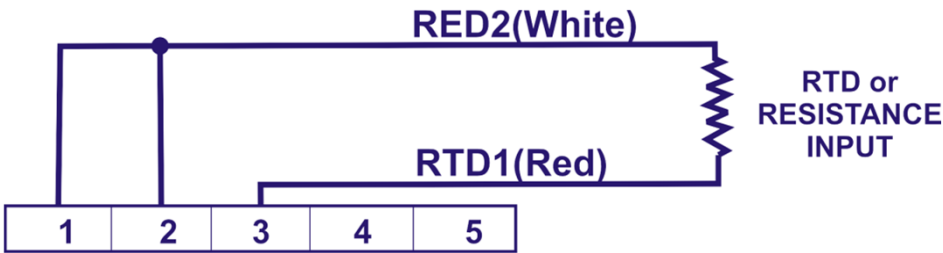
3.6. THERMOCOUPLE(TC) or mV INPUT



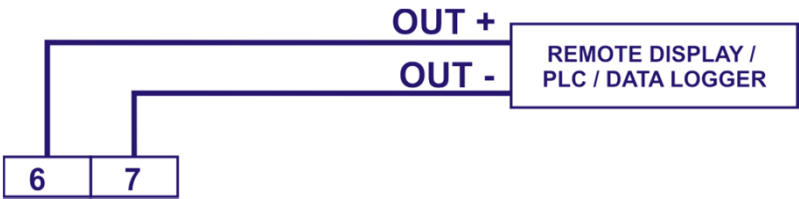
3.7. 3w RTD or RESISTANCE INPUT



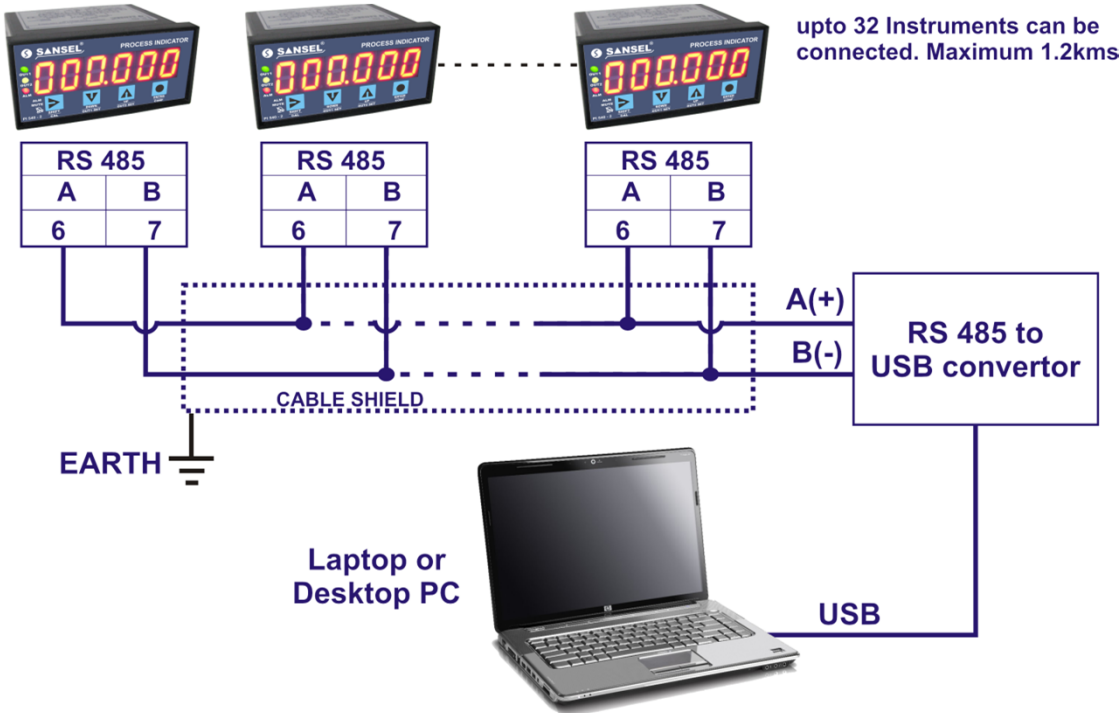
3.8. 2w RTD or RESISTANCE INPUT



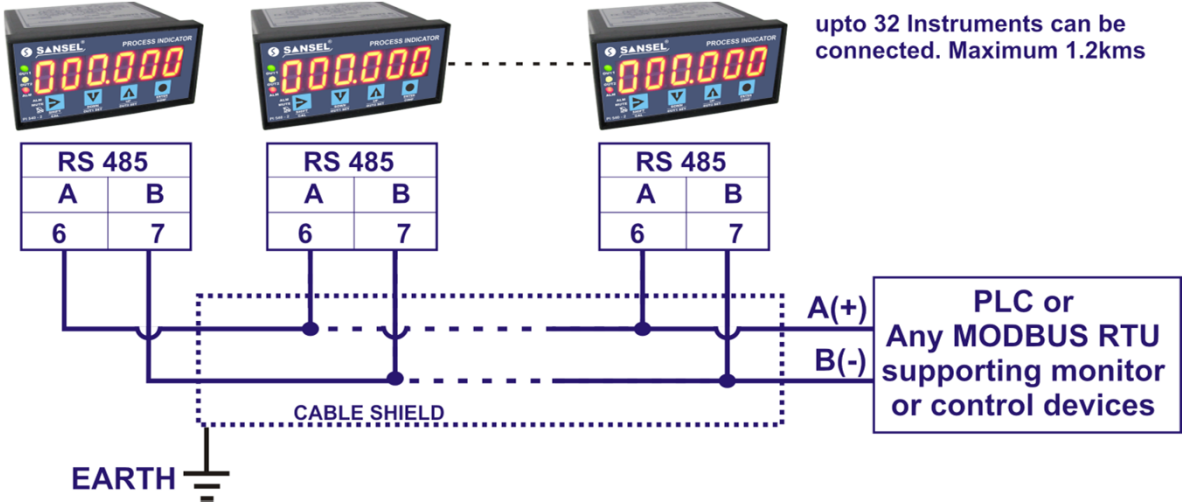
3.9. ANALOG RETRANSMISSION OUTPUT



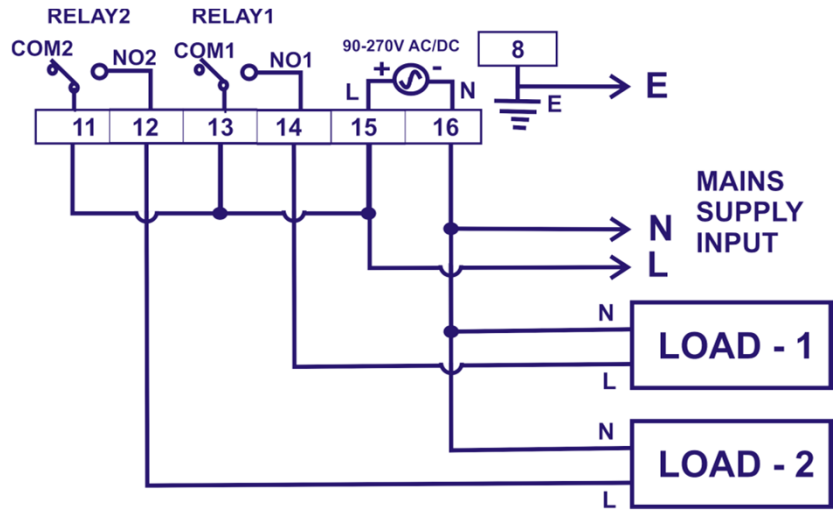
3.10. PC COMMUNICATION THROUGH RS 485



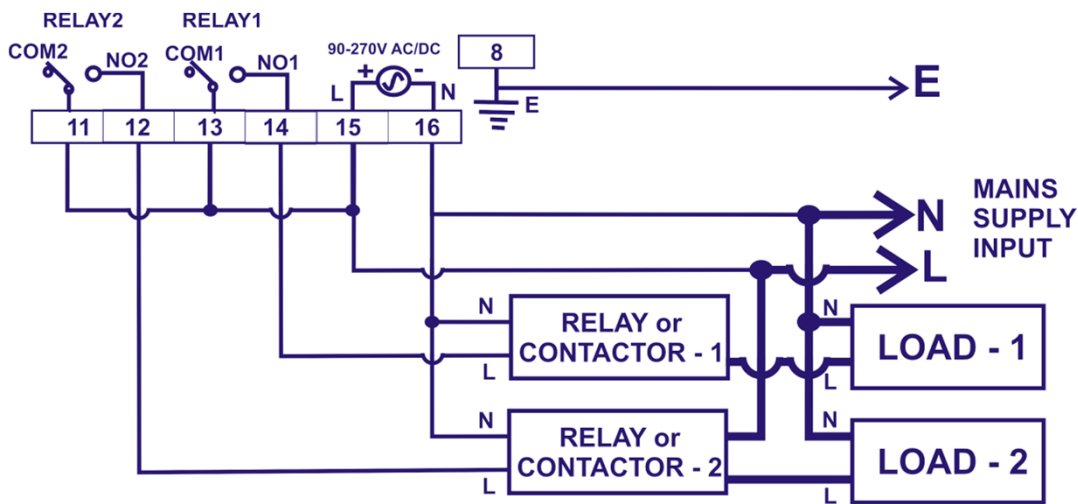
3.11. PLC or OTHER RS 485 MODBUS RTU supporting Device connection



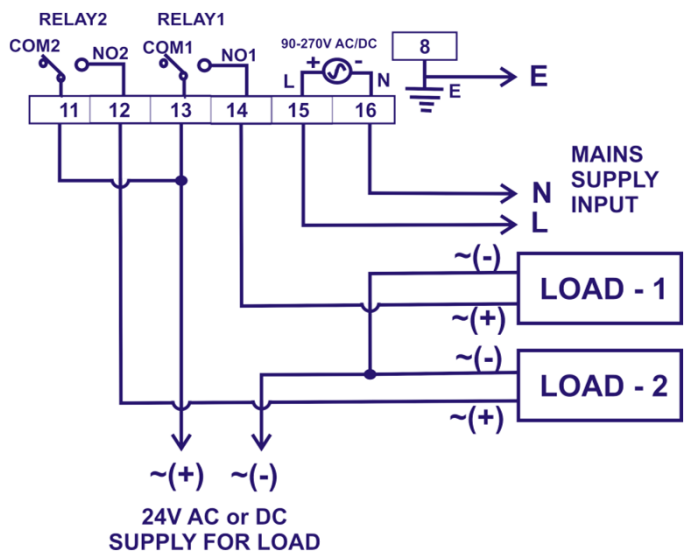
3.12. WIRING OF RELAY OUTPUT TO LOAD (SUPPLY 230V AC / BELOW 1kW LOAD)



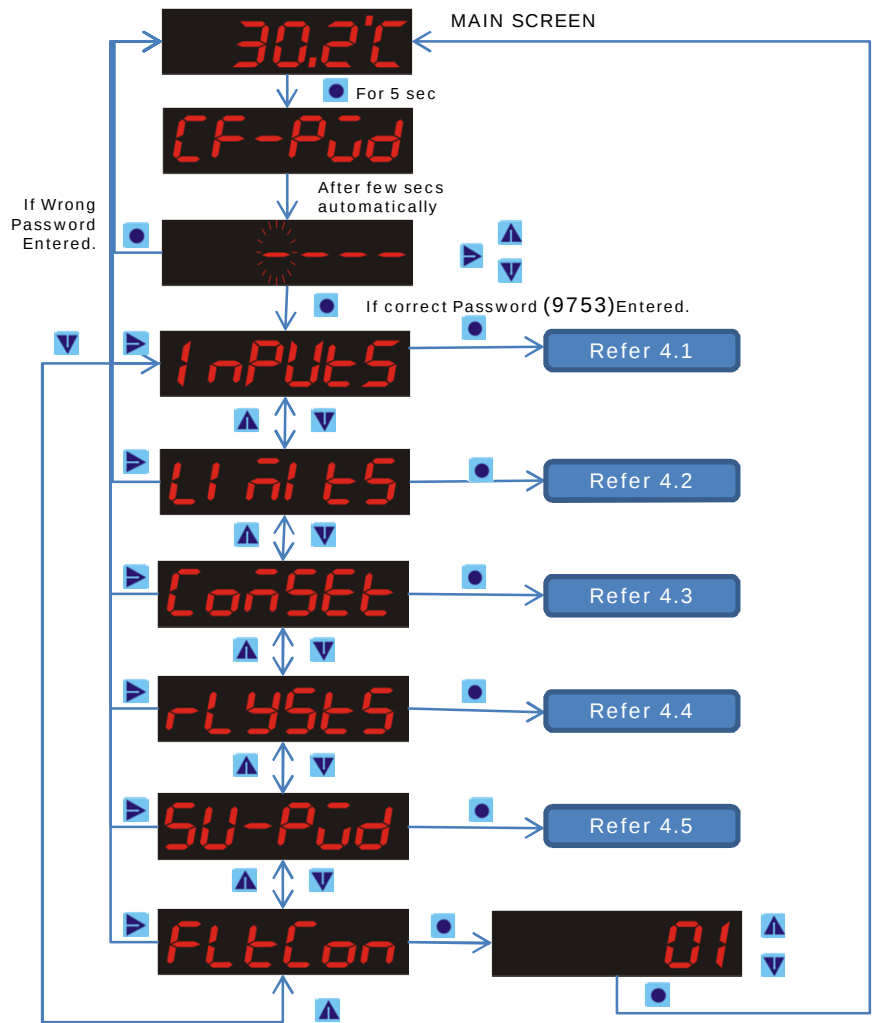
3.13. WIRING OF RELAY OUTPUT TO LOAD (SUPPLY 230V AC / ABOVE 1kW LOAD)



3.14. WIRING OF RELAY OUTPUT TO LOAD (SUPPLY 24V AC / DC)

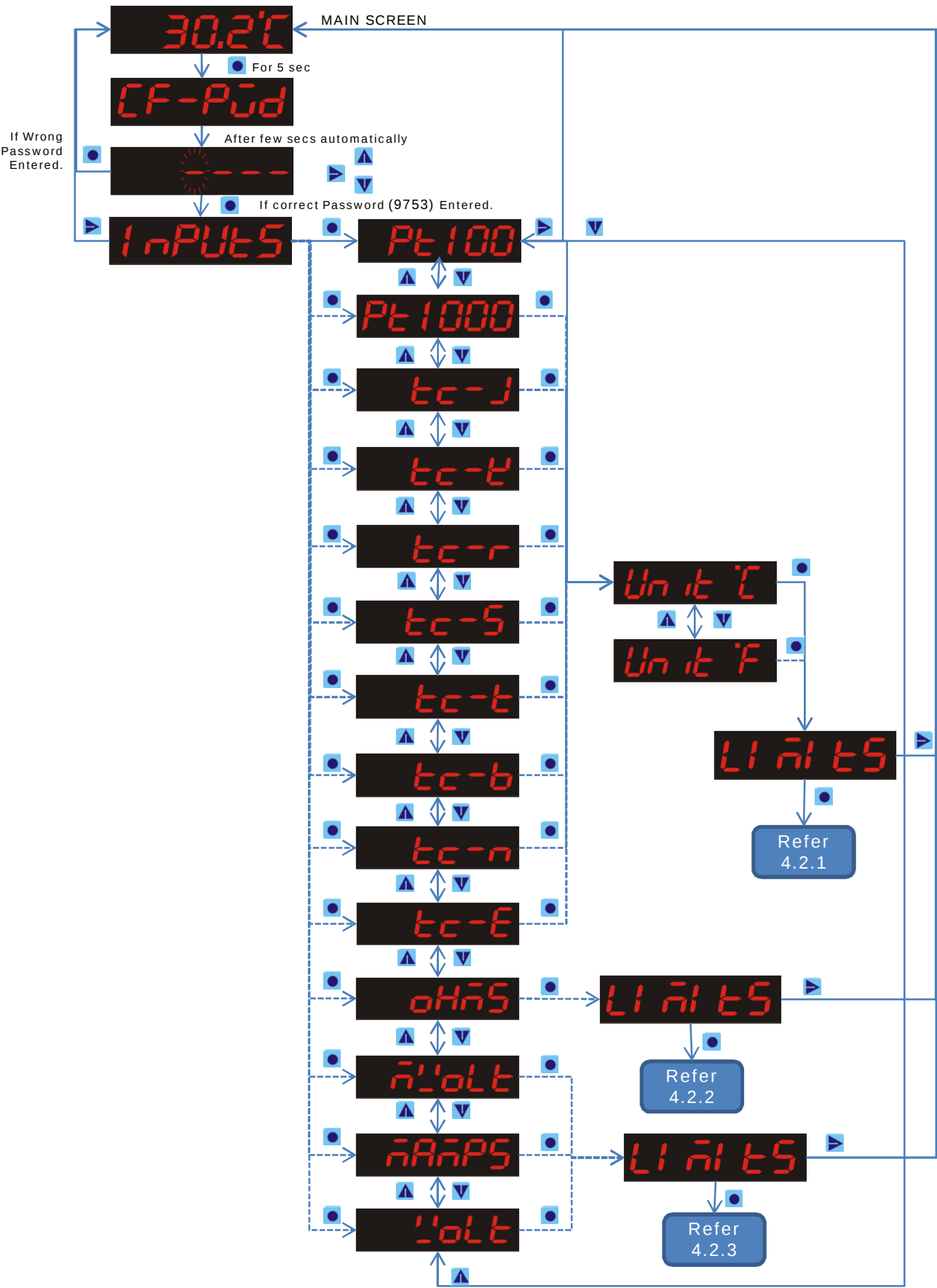


4. PROGRAMMING AND CONFIGURATION



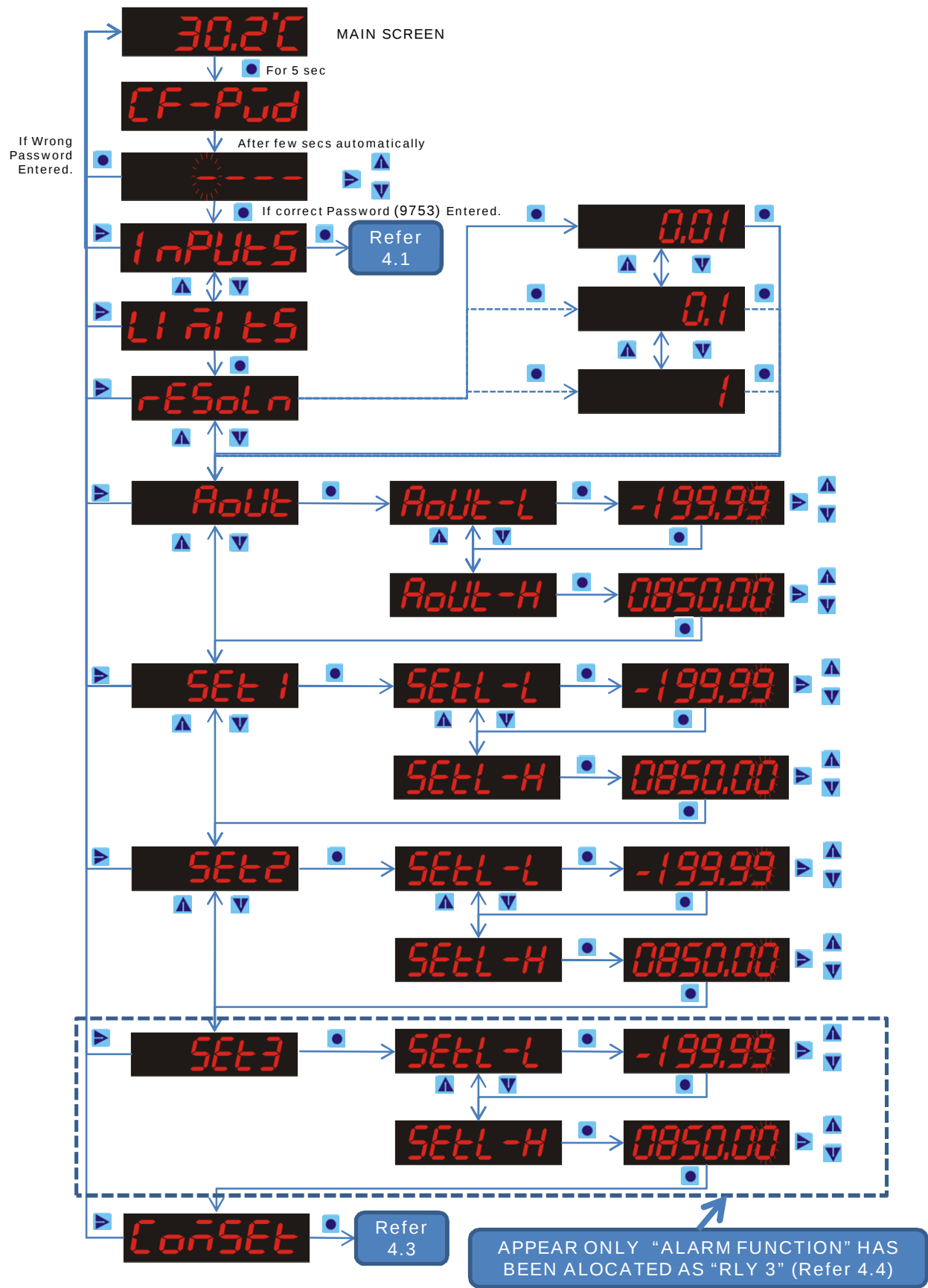
SYMBOL	NAME	DESCRIPTION
CF-Pwd	CONFIGURATION PASSWORD	To protect all settings menus from unauthorized persons.
INPUTS	INPUT TYPE SELECTION	To change the "SENSOR or INPUT TYPE".
LIMITS	LIMITS SETTINGS	To Configure Output Setvalue Limits, Resolution, Analog Input scale, Analog Display scale, Analog Output limits.
CONFSET	COMMUNICATION SETTINGS	To Configure the Slave ID, Baud rate and Parity.
FLYSets	RELAY & ALARM OUTPUT SETTINGS	To Configure the Output – 1 & 2 mode, Cyclic delay, Hysteresis, Alarm Function, Alarm Reset, Alarm Relay mode.
SU-Pwd	SET VALUE PASSWORD SETTINGS	To Switch ON, OFF & Change the Set Value password
FLtCon	FILTER CONSTANT	To Configure the Filter Constant value between 1 to 10.

4 .1. INPUT TYPE SELECTION

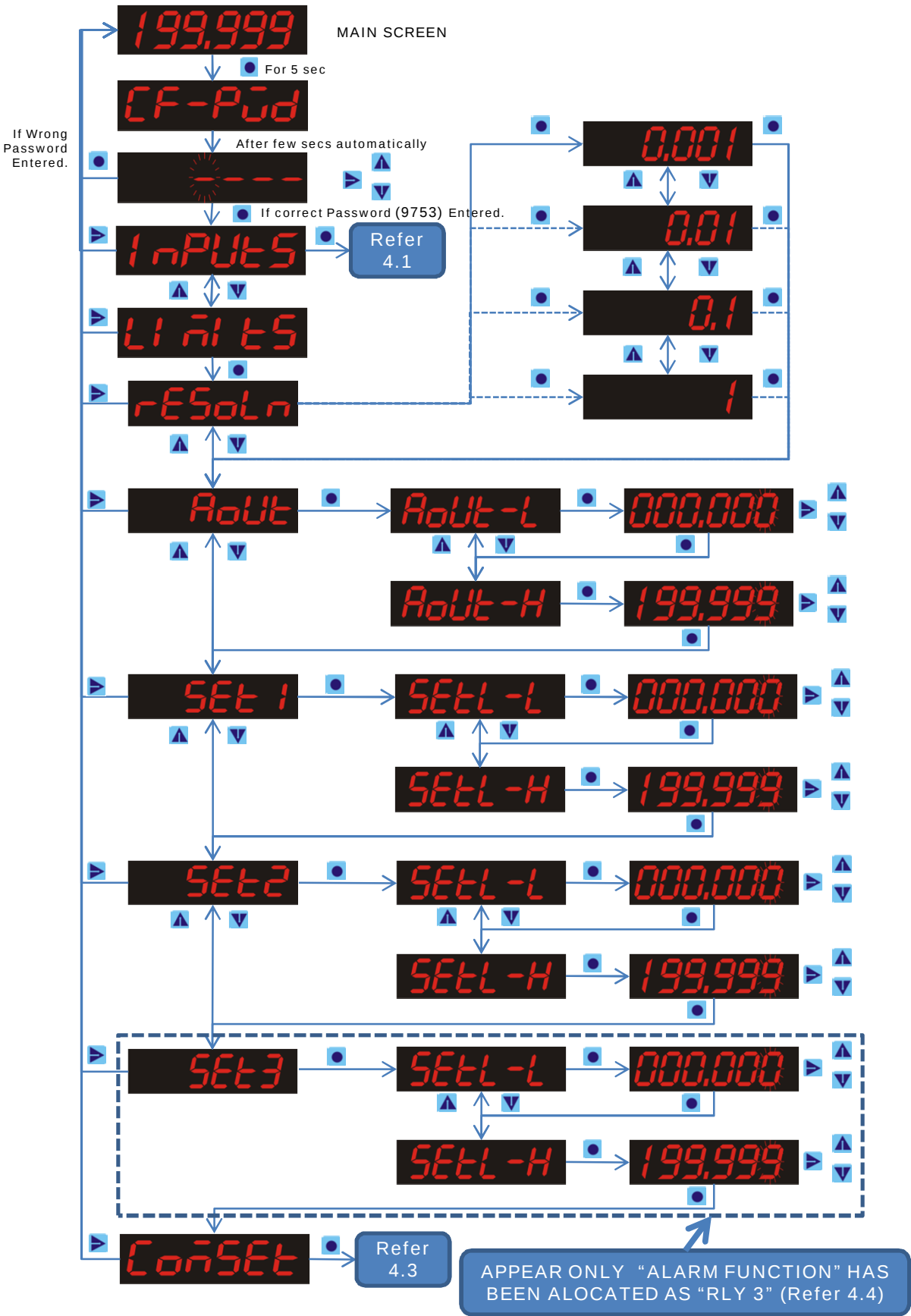


4.2. LIMITS SETTINGS

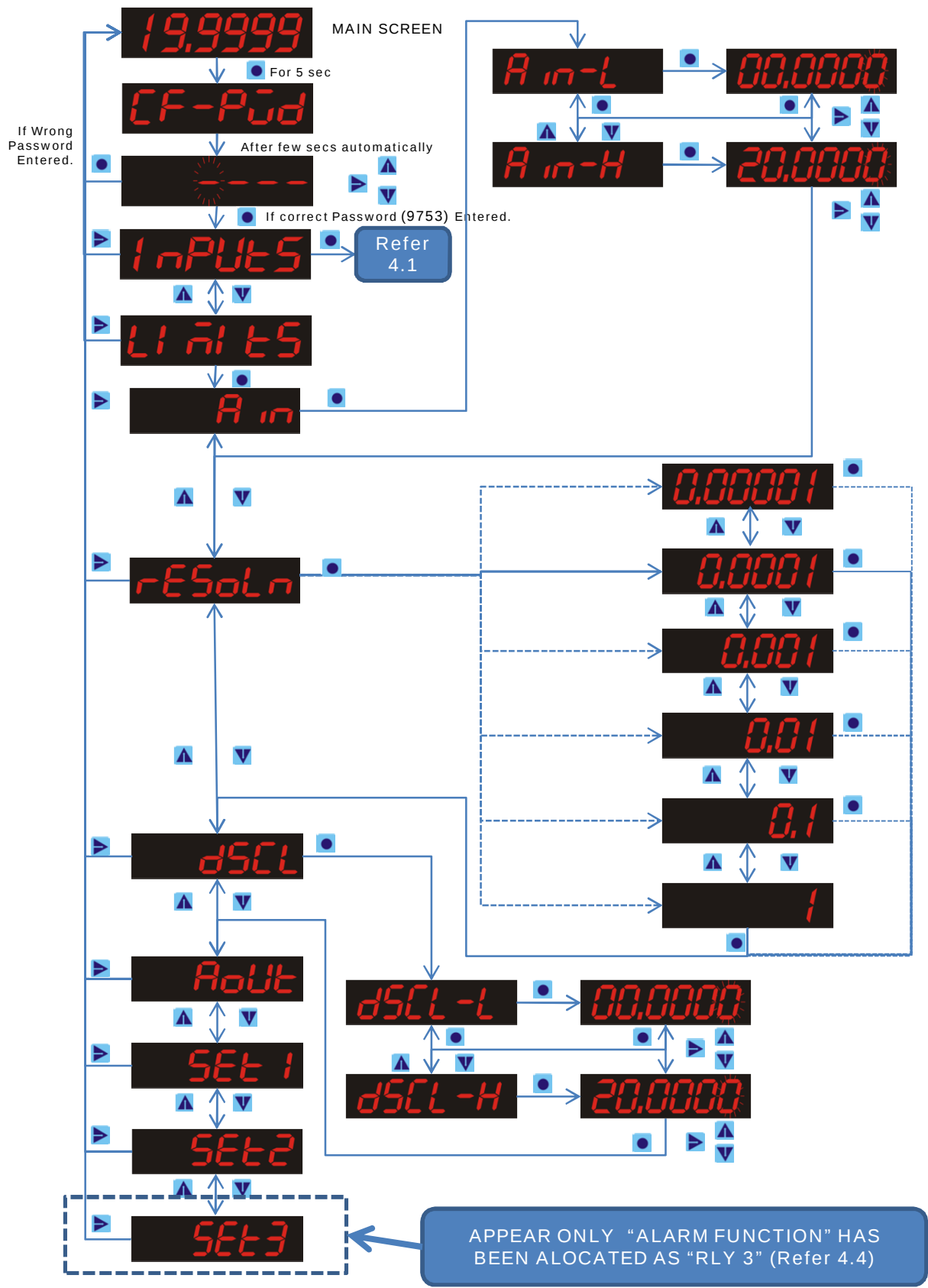
4.2.1. For Temperature Sensor Inputs (RTD & TC)



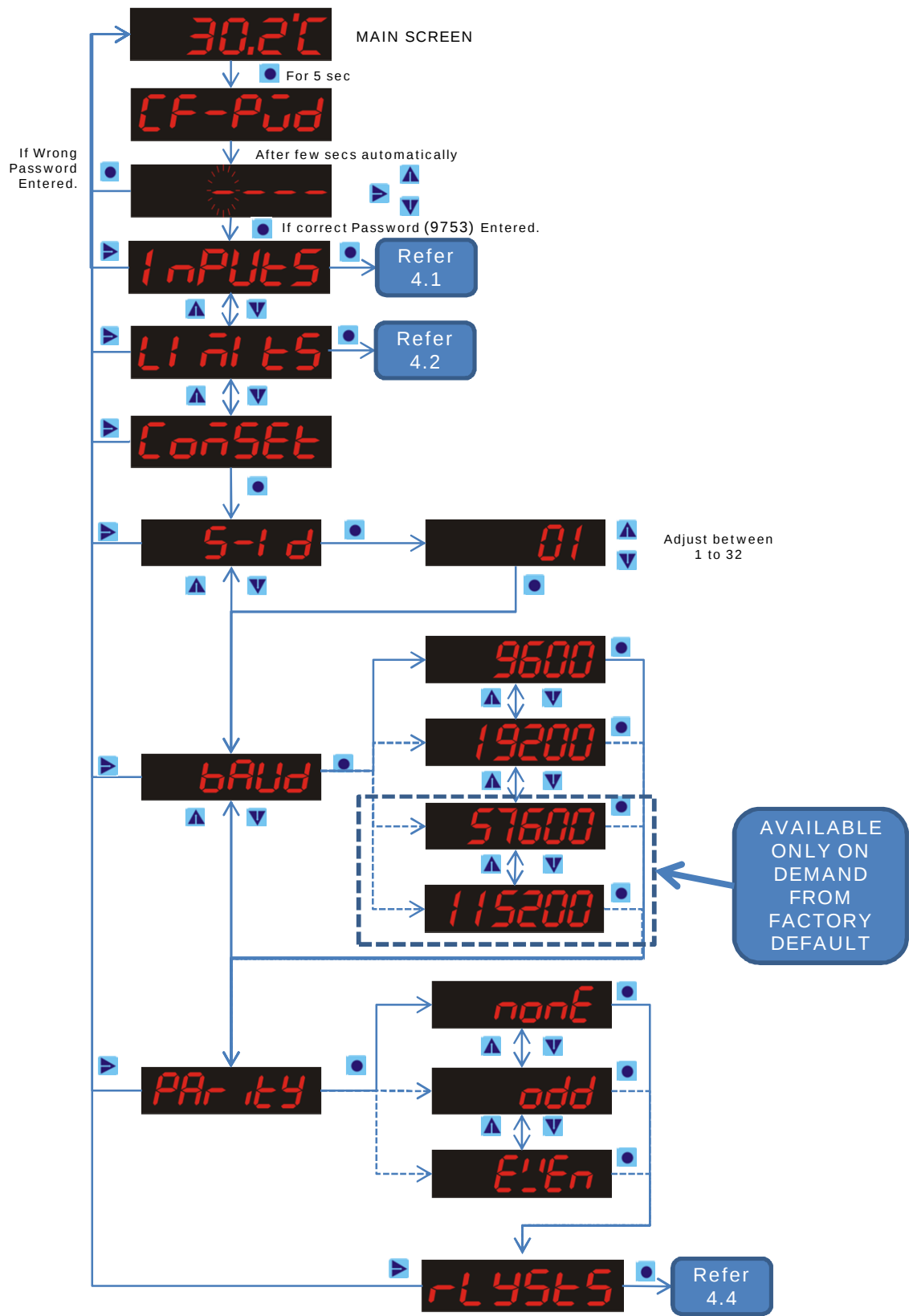
4.2.2. For Resistance Inputs (Ohms)



4.2.3. For Analog Inputs (mV, mA, Volt)

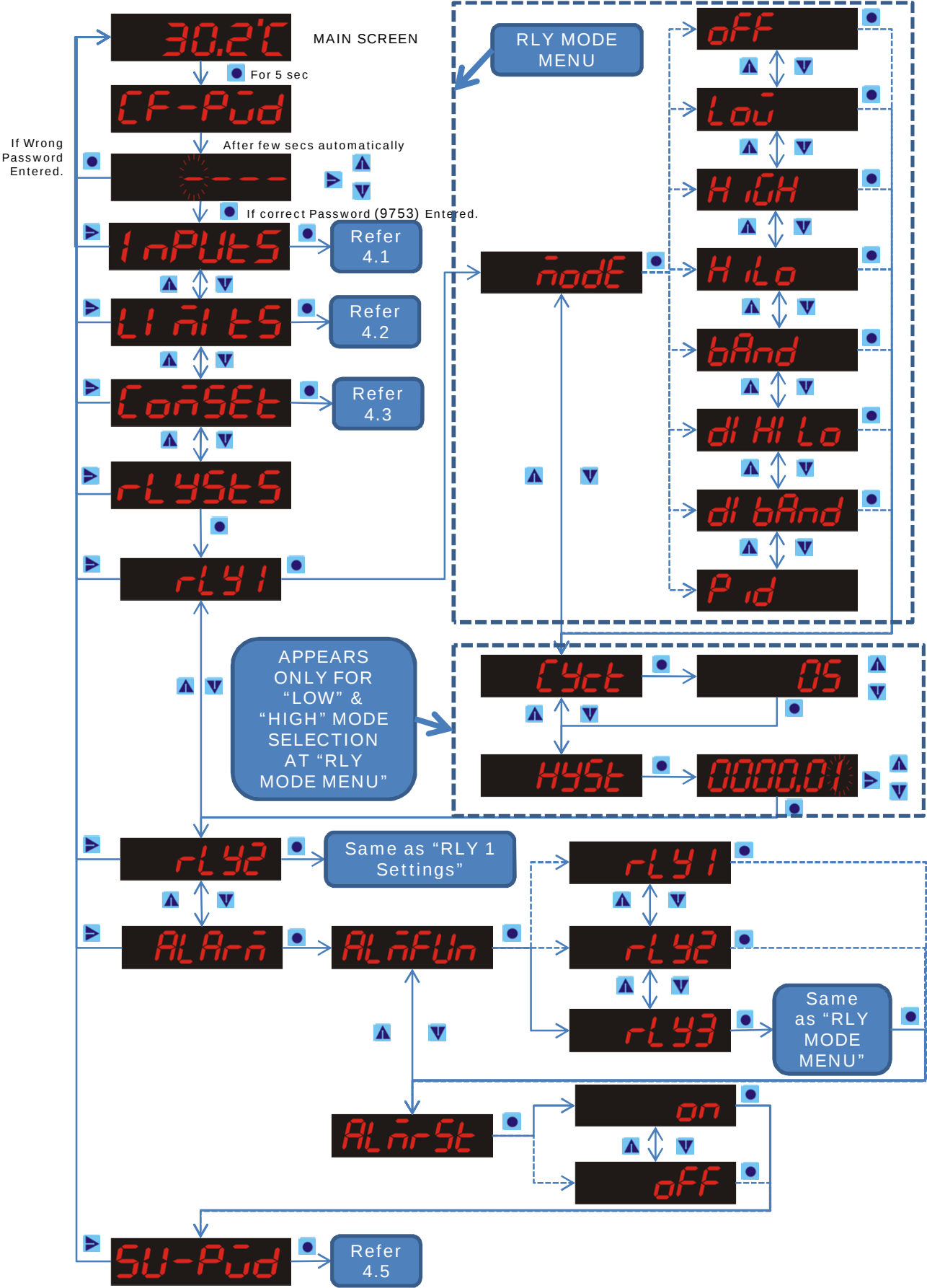


4.3. COMMUNICATION SETTINGS



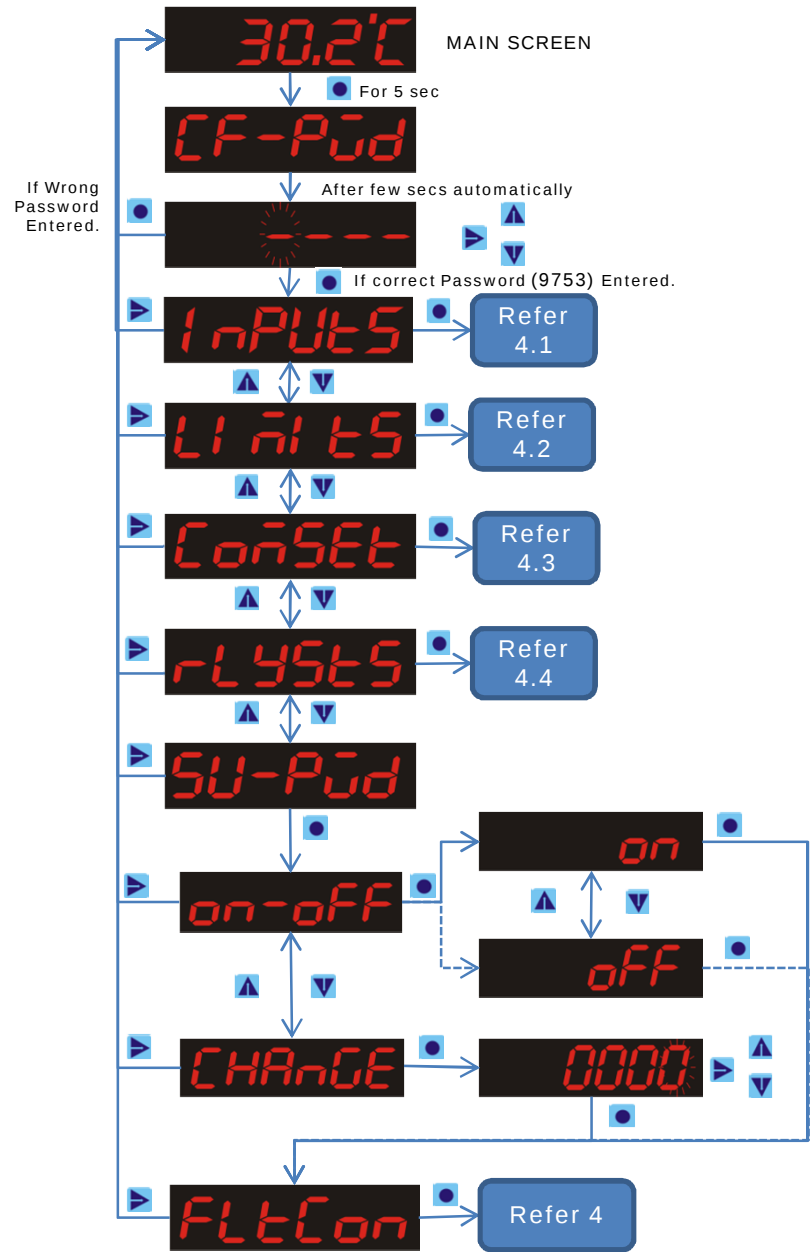
SYMBOL	NAME	DESCRIPTION
	PROCESS VALUE RESOLUTION	To Select the required "Resolution" of Process Value(PV) as per selected Input type.
	ANALOG RETRANSMISSION OUTPUT LIMIT	To Configure the "Analog Retransmission Output" range low and high limits.
	ANALOG RETRANSMISSION OUTPUT LOW LIMIT	To Configure the "Analog Retransmission Output Low Limit" for "4mA" output.
	ANALOG RETRANSMISSION OUTPUT HIGH LIMIT	To Configure the "Analog Retransmission Output High Limit" for "20mA" output.
	RELAY – 1 SET VALUE LIMIT	To Configure the "Relay – 1" Set value low and high limits.
	RELAY – 2 SET VALUE LIMIT	To Configure the "Relay – 2" Set value low and high limits.
	RELAY – 3 SET VALUE LIMIT	To Configure the "Relay – 3" Set value low and high limits. Note : Appears only "Alarm Function" is selected as "RLY – 3".
	ANALOG INPUT LIMIT	To Configure the "Analog Input" range low and high limits.
	ANALOG INPUT LOW LIMIT	To Configure the "Analog Input Low Limit" as per selected input type.
	ANALOG INPUT HIGH LIMIT	To Configure the "Analog Input High Limit" as per selected input type..
	DISPLAY SCALE LIMIT	To Configure the Process Value(PV) "Display Scale" range low and high limits.
	DISPLAY SCALE LOW LIMIT	To Configure the "Display Scale Low Limit"(-199999 to 200000 counts).
	DISPLAY SCALE HIGH LIMIT	To Configure the "Display Scale High Limit"(-199999 to 200000 counts)..
	COMMUNICATION SLAVE ID	To Configure the "Slave ID" to PI 541AInstrument between 1 to 32.
	COMMUNICATION BAUD RATE	To Configure the "Baud Rate" to PI 541AInstrument between 9600, 19200, 57600 & 115200 bps. Note : 57600 & 115200 bps baud rate supports on special hardware need to be installed on request at factory.

4.4. RELAY & ALARM OUTPUT SETTINGS



SYMBOL	NAME	DESCRIPTION
	RELAY – 1 SETTINGS	To Configure the “Relay – 1 settings”.
	RELAY – 2 SETTINGS	To Configure the “Relay – 2 settings”.
	ALARM SETTINGS	To Configure the “Alarm settings”.
	RELAY OUTPUT MODE	To Configure the “Relay Output Mode”.
	RELAY OUTPUT HYSTERESIS	To Configure the “Relay Output Hysteresis”.
	RELAY OUTPUT CYCLIC ON DELAY	To Configure the “Relay Output Cyclic ON delay”.
	RELAY OFF	To Switch OFF the “Relay Output” at any condition of PV.
	LOW	To Switch ON “Relay Output” during PV below “Low Set value” and Switch OFF above “Low Set value”.
	HIGH	To Switch ON “Relay Output” during PV above “High Set value” and Switch OFF below “High Set value”.
	HIGH & LOW	To Switch ON “Relay Output” during PV above “High Set value” and below “Low Set value”. Switch OFF between both set values.
	BAND	To Switch OFF “Relay Output” during PV above “High Set value” and below “Low Set value”. Switch ON between both set values.
	DIFFERENTIAL HIGH & LOW	To Switch ON “Relay Output” during PV below “Low Set value” till the “High Set value” reach. Then Switch OFF after reaching “High Set value” till the “Low Set value” reach.
	DIFFERENTIAL BAND	To Switch OFF “Relay Output” during PV below “Low Set value” till the “High Set value” reach. Then Switch ON after reaching “High Set value” till the “Low Set value” reach.
	PID MODE	For future use. Note : Don't select this mode.
	ALARM FUNCTION	To Configure the “Alarm Function”, to which relay output activate for Alarm output.
	ALARM RESET	To Configure the “Alarm Reset”. During alarm output activated, need to “Reset” the output by pressing front “ALM MUTE” key. The Reset will be “Enable(ON)” or “Disable(OFF)” using this function.

4.5. SET VALUE PASSWORD SETTINGS



SYMBOL	NAME	DESCRIPTION
	SET VALUE PASSWORD ON/OFF	To Enable(ON) or Disable(OFF) Relay output Set value entry password.
	PASSWORD ON	To Enable(ON) Relay Set value entry password.
	PASSWORD OFF	To Disable(OFF) Relay Set value entry password.
	CHANGE PASSWORD	To Change new Relay Set value password.

5. CALIBRATION PROCEDURE FOR PI 540 – 2

5.1. PROCESS VALUE (PV) CALIBRATION

For better accuracy, Calibration of the PI 541A is recommended. In addition, the PI 541A must be recalibrated whenever:

- The sensor is replaced.
- After testing long term in high temperature.
- Where high accuracy is required.
- At least twice an year.

NOTE : For Best results, calibrate with certified accurate standard source. Follow the steps given below to field calibrate the PI 541A. PI 541A has a 2 POINT(zero & span) calibration.

STEP 1 : Adjust “Process Value(PV)” using standard source to give a constant minimum Input

STEP 2 : Measure PV for a test time period (ex. 1 min)

STEP 3 : If error occurs in the minimum reading, adjust the error using following steps, otherwise ignore it.

STEP 4 : In Main Screen, to Enter into the “Zero Calibration” Mode, Press MODE Key till the Display Shows



The display shows "PI-CAL" in red LED characters on a black background.

STEP 5 : Then press ENTER Key to enter into the “Zero Calibration” the Display Shows “ZERO”, again press ENTER key the minimum error read displays.



The display shows "Zero" in red LED characters. A blue arrow points to the right, where the display shows "00.0024" in red LED characters. To the right of the second display are two blue square buttons with white up and down arrows.

STEP 6 : Then use UP & DN keys to adjust the error reading to master reading and press ENTER Key again to save and exit to main screen.

STEP 7 : Measure PV for a test time period (ex. 1 min)

STEP 8 : If error occurs in the maximum reading, adjust the error using following steps, otherwise ignore it.

STEP 9 : In Main Screen, to Enter into the “Span Calibration” Mode, Press MODE Key till the Display Shows



The display shows "PI-CAL" in red LED characters on a black background.

STEP 10 : Then press ENTER Key to enter into the “Span Calibration” the Display Shows “ZERO”, press UP key to scroll the display to “SPAN” as follows.



STEP 11 : Then press ENTER Key the maximum error read displays, use UP & DN keys to adjust the error reading to master reading and press ENTER Key to save and exit to main screen.



5.2. ANALOG RETRANSMISSION OUTPUT CALIBRATION

For better accuracy, Calibration of the PI 541A Analog output is recommended with the master measure unit(like mA / V measurable multi meter) or any remote display unit. In addition, the PI 541A must be recalibrated whenever:

- The measure or display unit is replaced.
- After testing long term in high temperature.
- Where high accuracy is required.
- At least twice an year.

NOTE : For Best results, calibrate with certified accurate standard measure. Follow the steps given below to field calibrate the PI 541A analog output. PI 541A has a 2 POINT(zero & span) analog output calibration.

STEP 1 : Connect the Analog Output of PI 541A Analog output to master measure or remote display unit (Refer 3.9.).

STEP 2 : In Main Screen, to Enter into the “Analog output Calibration” Mode, Press MODE Key till the Display Shows “PV-CAL”, now press UP key the display enters the “Analog output calibration mode.



STEP 3 : Then press ENTER Key to enter into the output “zero calibration” the Display Shows “ZERO”, again press ENTER key the display shows “Zero”, now press ENTER key the display shows present “zero” count value, simultaneously “Analog output” terminal gives the minimum output (4mA).



STEP 6 : Then use UP & DN keys to roll over 0 – 9 and move blinking digit by MODE key to adjust the zero count value to adjust the output measure read to 4mA and press ENTER Key to save and enter into the output “SPAN” calibration mode as follows.



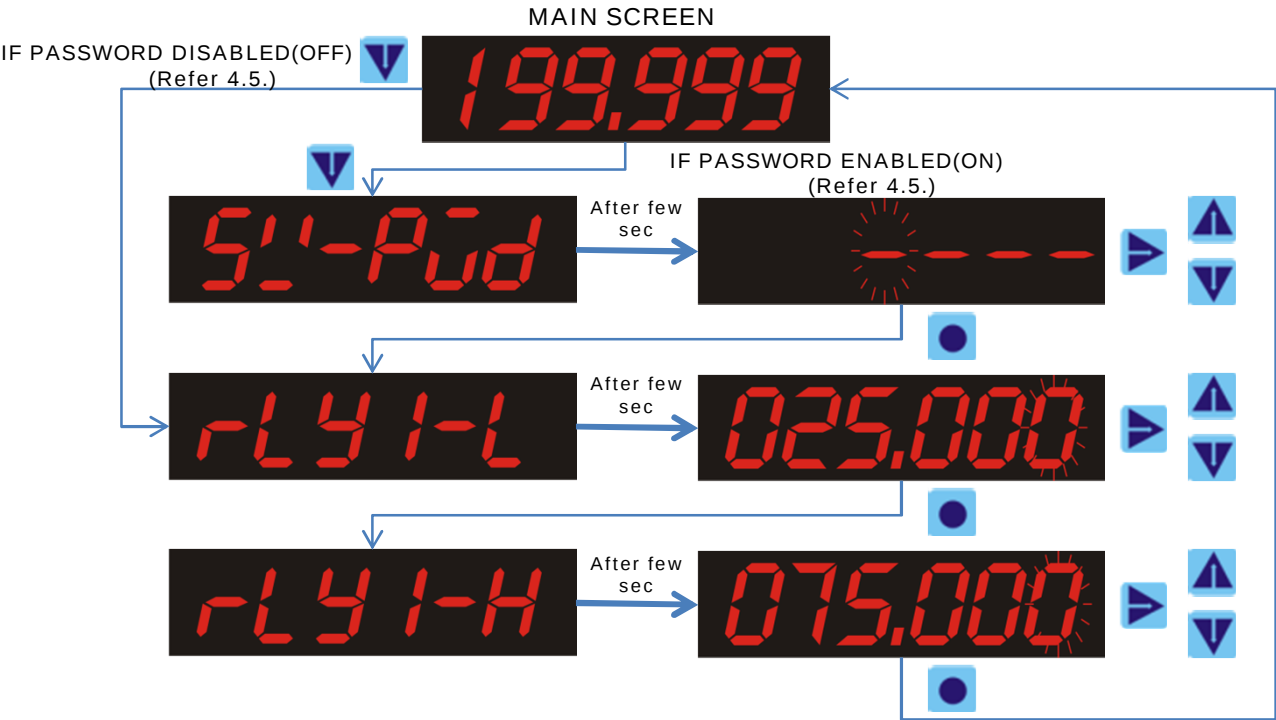
STEP 7 : Then use UP & DN keys to roll over 0 – 9 and move blinking digit by MODE key to adjust the Span count value to adjust the output measure read to 20mA and press ENTER Key to save and exit to main screen.

6. RELAY OUTPUT SETVALUE

This Relay set values used to alert the local operator by glowing audible buzzer attached inbuilt(optional) in PI 541A & also used to control any process using relay contact(5A rated). To view & Configure the “RELAY SETVALUES” follow the steps below.

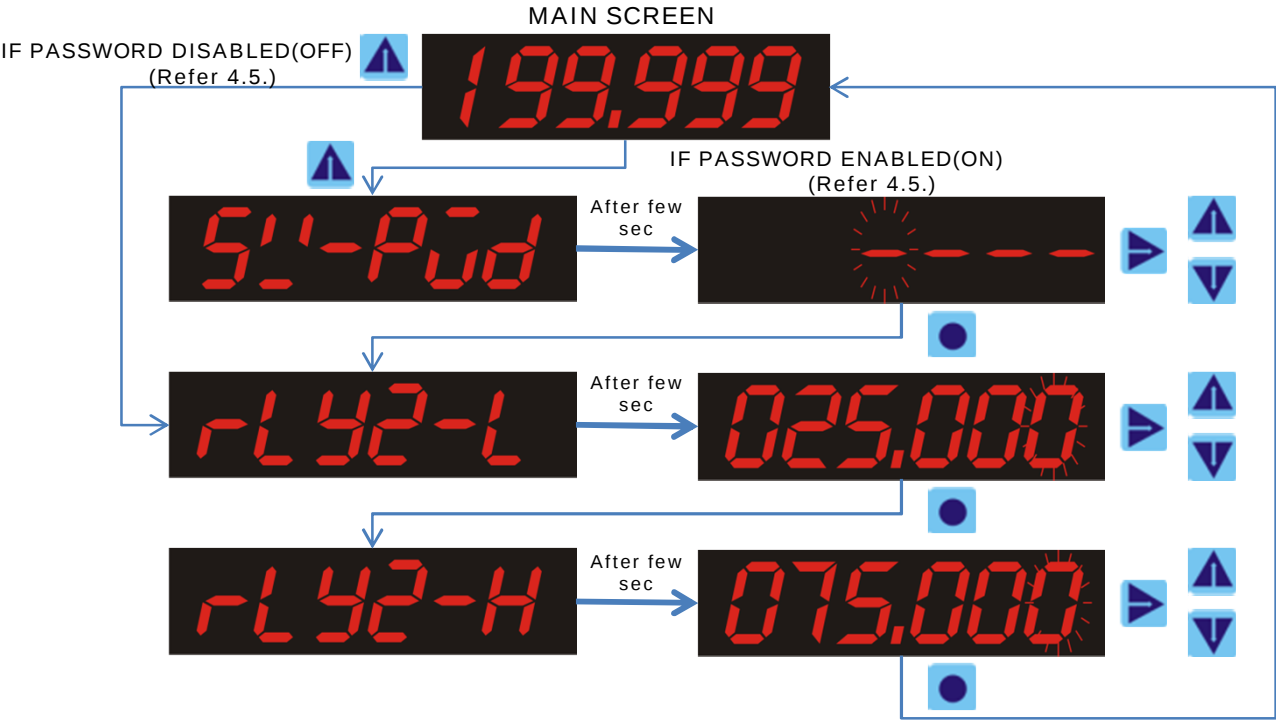
6.1. RELAY – 1 SET VALUE

In Main Screen, Press DN Key till the Display Shows “SV – PWD” as follows



6.2. RELAY – 2 SET VALUE

In Main Screen, Press UP Key till the Display Shows “SV – PWD” as follows



7. MODBUS PROTOCOL DETAILS

7.1. MODBUS ADDRESSES

This is a complete list of parameters MODBUS Addresses available in the PI 541A.

Parameter	Address (Lower word)	Address (Higher word)	Data format	Function	Actual value count(A)	Factor *	Description
Process value (PV)	0	1	long integer	Read only	-199999 to 200000	See Table **	Actual reading of PV
Output – 1 low set	2	3	long integer	Read & write	As per set limit – 1		Output – 1 low set value
Output – 1 High set	4	5	long integer	Read & write	As per set limit – 1		Output – 1 high set value
Output – 2 low set	6	7	long integer	Read & write	As per set limit – 2		Output – 2 low set value
Output – 2 High set	8	9	long integer	Read & write	As per set limit – 2		Output – 2 high set value
Analog Input low	10	11	long integer	Read & write	As per type	= A /1000	Analog input limits
Analog Input High	12	13	long integer	Read & write	As per type		For mV → 0 to 75mV For mA → 0 to 20mA For Volt → 0 to 10V
Display Scale Low	14	15	long integer	Read & write	-199999 to 200000	See Table **	Display Scale Low Limit
Display Scale High	16	17	long integer	Read & write	-199999 to 200000		Display Scale High Limit
Analog Out Low	18	19	long integer	Read & write	As per Display scale		Analog Out Low Limit
Analog Out High	20	21	long integer	Read & write	As per Display scale		Analog Out High Limit

Parameter	Address (Lower word)	Address (Higher word)	Data format	Function	Actual value count(A)	Factor *	Description
Output – 1 low set limit	22	23	long integer	Read & write	-199999 to 200000	See Table **	Output – 1 low set limit
Output – 1 high set limit	24	25	long integer	Read & write	-199999 to 200000		Output – 1 high set limit
Output – 2 low set limit	26	27	long integer	Read & write	-199999 to 200000		Output – 2 low set limit
Output – 2 high set limit	28	29	long integer	Read & write	-199999 to 200000		Output – 2 high set limit
Output – 1 Hysteresis	30	31	long integer	Read & write	0 to 100000		Output – 1 Hysteresis value
Output – 2 Hysteresis	32	33	long integer	Read & write	0 to 100000		Output – 2 Hysteresis value
SV password	79		integer	Read & write	0 to 9999	=A/1	SV password value
Output – 1 cyclic time	80		integer	Read & write	0 to 250		Output – 1 cyclic time value in seconds
Output – 2 cyclic time	81		integer	Read & write	0 to 250		Output – 2 cyclic time value in seconds
Input type	82		Integer	Read & write	0 to 13		0 → RTD-PT 100, 1 → RTD-PT 1000, 2 → TC-J, 3 → TC-K, 4 → TC-R, 5 → TC- S, 6 → TC-T, 7 → TC-B, 8 → TC-N, 9 → TC-E, 10 → OHMS, 11 → mV, 12 → mA, 13 → Volt
Unit	83		integer	Read & write	0 to 1		0 → DegC, 1 → DegF
Resolution	84		integer	Read & write	0 to 5		0 → 1, 1 → 0.1, 2 → 0.01, 3 → 0.001, 4 → 0.0001, 5 → 0.00001
Output – 1 control Mode	85		integer	Read & write	0 to 7		0 → OFF, 1 → Low, 2 → High, 3 → High Low, 4 → Band, 5 → Differential High Low, 6 → Differential Band, 7 → PID
Output – 2 control Mode	86		integer	Read & write	0 to 6		0 → OFF, 1 → Low, 2 → High, 3 → High Low, 4 → Band, 5 → Differential High Low, 6 → Differential Band
SV password on/off	87		integer	Read & write	0 to 1		0 → OFF, 1 → ON
Filter constant	88		integer	Read & write	1 to 20		Display Filter constant value
Slave Id	89		integer	Read & write	1 to 32		Communication Slave address
Baud rate	90		integer	Read & write	0 to 3		0 → 9600, 1 → 19200, 2 → 57600, 3 → 115200
Parity	91		integer	Read & write	0 to 2		0 → None, 1 → Odd, 2 → Even
Status bits	95		bit	Read only	0 to 1		Bit 0 → Out – 1 Bit 1 → Out – 2 Bit 2 → OPEN SENSOR Bit 3 → below LOW limit Bit 4 → Above HIGH limit

Note : *Read Final value of any above parameter, after applying the “Actual read” to “Factor” given.

** Read Final value of some selected parameters above, as per table below.

Resolution	Factor**	Resolution	Factor**	Resolution	Factor**
1	=A/1	0.01	=A/100	0.0001	=A/10,000
0.1	=A/10	0.001	=A/1000	0.00001	=A/1,00,000

7.2. MODBUS MASTER QUERY AND RESPONSE
FEEDBACKS FROM PI 541A

PI 541A supports the RTU Mode in MODBUS communications. This device acts like a slave device in the MODBUS network. The slave address with which the unit is Configurable(Ref. 4.3) between 1 to 32(decimal). PI 541A supports functions 03 of the MODBUS protocol.

7.2.1.COMMUNICATION PARAMETERS:

Baud Rate : 9600(Configurable Ref. 4.3)
Flow Control : NONE
No of data bits : 8
Parity : NONE(Configurable Ref. 4.3)
No of Stop Bits : 1(Configurable Ref. 4.3)

7.2.2. SUPPORTED FUNCTIONS AND SCOPE:

Function 03 – Read Holding registers

7.2.3. QUERY FROM MASTER DEVICE (For Long Integer Data formats)

Field Name	Example (Hex)
Slave Address	01
Function	03
Start Address Hi (Refer 7.2.7)	00
Start Address Lo (Refer 7.2.7)	00
No of Registers to read Hi	00
No of Registers to read Lo	02
Error Check	CRC

The above example is a typical example of supported format for function # 03.

7.2.4. RESPONSE FROM PI 541A(For Long Integer Data formats)

Field Name	Example (Hex)
Slave Address	01
Function	03
Byte Count	04
Data Hi1	xx
Data Lo1	xx
Data Hi2	xx
Data Lo2	xx
Error Check	CRC

7.2.5. QUERY FROM MASTER DEVICE (For Integer Data formats)

Field Name	Example (Hex)
Slave Address	01
Function	03
Start Address Hi(Refer 7.2.7)	00
Start Address Lo(Refer 7.2.7)	4F
No of Registers to read Hi	00
No of Registers to read Lo	01
Error Check	CRC

The above example is a typical example of supported format for function # 03.

7.2.5. RESPONSE FROM PI 541A(For Integer Data formats)

Field Name	Example (Hex)
Slave Address	01
Function	03
Byte Count	02
Data Hi	xx
Data Lo	xx
Error Check	CRC

7.2.7. MODBUS QUERY LIST IN HEX DECIMAL(hex)

Parameter	Function	Address		No. of Registers to Read Hi	No. of Registers to Read Lo
		Start Address Hi	Start Address Lo		
Process value (PV)	03	00	00	00	02
Output – 1 low set	03	00	02	00	02
Output – 1 High set	03	00	04	00	02
Output – 2 low set	03	00	06	00	02
Output – 2 High set	03	00	08	00	02
Analog Input low	03	00	0A	00	02
Analog Input High	03	00	0C	00	02
Display Scale Low	03	00	0E	00	02
Display Scale High	03	00	10	00	02
Analog Out Low	03	00	12	00	02
Analog Out High	03	00	13	00	02

Parameter	Function	Address		No. of Registers to Read Hi	No. of Registers to Read Lo
		Start Address Hi	Start Address Lo		
Output – 1 low set limit	03	00	16	00	02
Output – 1 high set limit	03	00	18	00	02
Output – 2 low set limit	03	00	1A	00	02
Output – 2 high set limit	03	00	1C	00	02
Output – 1 Hysteresis	03	00	1E	00	02
Output – 2 Hysteresis	03	00	20	00	02
SV password	03	4F		00	01
Output – 1 cyclic time	03	50		00	01
Output – 2 cyclic time	03	51		00	01
Input type	03	52		00	01
Unit	03	53		00	01
Resolution	03	54		00	01
Output – 1 control Mode	03	55		00	01
Output – 2 control Mode	03	56		00	01
SV password on/off	03	57		00	01
Filter constant	03	58		00	01
Slave Id	03	59		00	01
Baud rate	03	5A		00	01
Parity	03	5B		00	01
Status bits	03	4F		00	01

7.2.8. MORE ON UNSUPPORTED FUNCTIONS:

Unsupported functions will not return a response from PI 541A . However continuing development will ensure that more Functions will be added to this model in future releases. For specific Functional requirements please contact us.