

RISH Master 3428

3 Phase (3Wire / 4Wire)

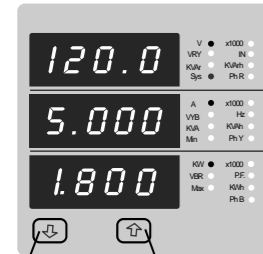
Three Phase Multi-function Digital Meter Installation & Operating Instructions

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1. Introduction

This instrument is a panel mounted 96 x 96mm DIN Quadratic Digital metering system for the measurement important electrical parameters like AC Voltage, AC Current, Frequency, Power, Energy(Active / Reactive / Apparent) . The instrument integrates accurate measurement technology (All Voltages & Current measurements are True RMS upto 15th Harmonic) with 3 line 4 digits Ultra high brightness LED display.



The instrument can be configured and programmed at site for the following : PT Primary, CT Primary, CT Secondary (5A or 1A) and 3 phase 3W or 4W system.

The front panel has two push buttons through which the user may scroll through the available measurement readings, reset the energy , Min/Max (System Voltage and System Current) and configure the product.

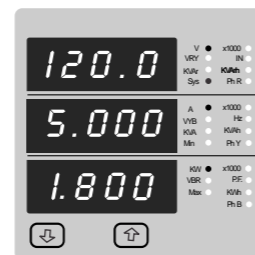
TABLE 1:

Measured Parameters	Units of measurement
System Voltage	Volts
System Current	Amps
Frequency	Hz
Voltage VL1-N(4wire only)	Volts
Voltage VL2-N(4wire only)	Volts
Voltage VL3-N(4wire only)	Volts
Voltage VL1-L2	Volts
Voltage VL2-L3	Volts
Voltage VL3-L1	Volts
Current L1	Amps
Current L2	Amps
Current L3	Amps
Active Power (System / Phase (4 wire only))	Kwatts
Reactive Power (System / Phase (4 wire only))	KVAR
Apparent Power (System / Phase (4 wire only))	KVA
Power Factor (System / Phase (4 wire only))	
Active Energy (8 Digit resolution)	kWh
Reactive Energy (8 Digit resolution)	kVArh
Apparent Energy (8 Digit resolution)	kVAh
Neutral Current (4 wire only)	Amp

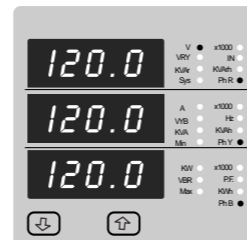
2. Measurement Reading Screens

In normal operation the user is presented with one of the measurement reading screens out of several screens. These screens may be scrolled through one at a time in incremental order by pressing the "Up key" and in decremental order by pressing "Down key".

Screen 1 : System screen (System Voltage, System Current, System Active Power)



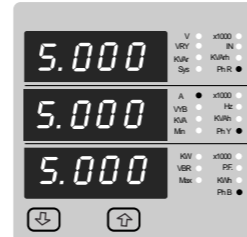
Screen 2 : Line to Neutral Voltages (for 4 wire only)



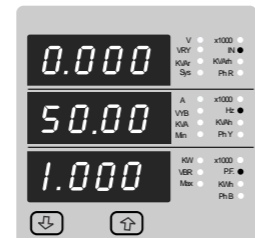
Screen 3 : Line to Line Voltages



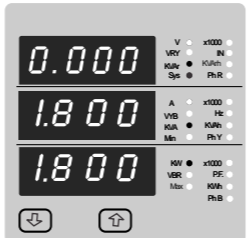
Screen 4 : Line Currents



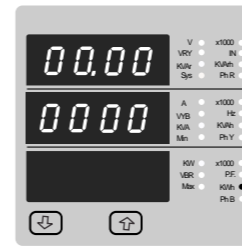
Screen 5 : Neutral current (for 4W only) , Frequency, Sys. Power Factor



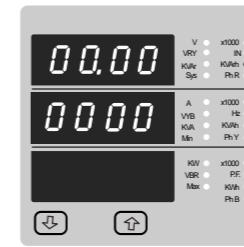
Screen 6 : System Power (Reactive, Apparent, Active)



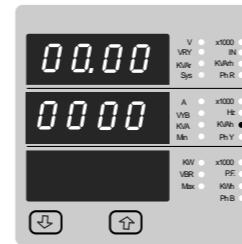
Screen 7 : Active Energy



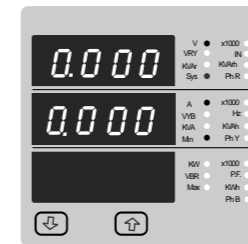
Screen 8 : Reactive Energy



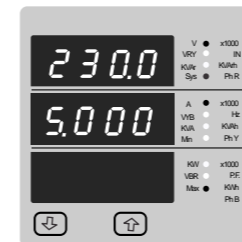
Screen 9 : Apparent Energy



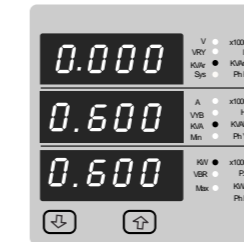
Screen 10 : Min Sys Voltage & Current



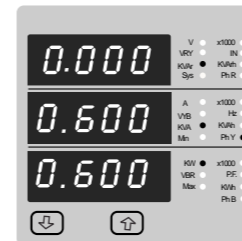
Screen 11 : Max Sys Voltage & Current



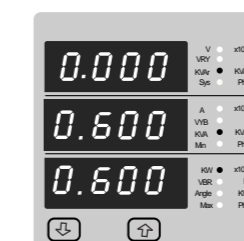
Screen 12 : Phase Power (R) Reactive/ Apparent /Active (for 4W only)



Screen 13 : Phase Power (Y) Reactive/ Apparent /Active (for 4W only)



Screen 14 : Phase Power (B) Reactive/ Apparent /Active (for 4W only)



Screen 15 : Phase Power Factor (Phase R / Y / B) (for 4W only)



3. Programming

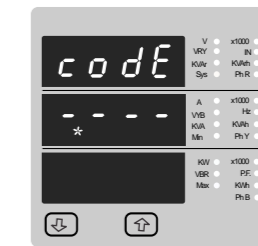
The following sections comprise step by step procedures for configuring the Instrument for individual user requirements.

To access the set-up screens press and hold the "Down" and "Up" Key simultaneously for 5 seconds. This will take the User into the Password Protection Entry Stage (Section 3.1).

3.1. Password Protection

Password protection can be enabled to prevent unauthorised access to set-up screens, by default password protection is not enabled.

Password protection is enabled by selecting a four digit number other than 0000, setting a password of 0000 disables the password protection.

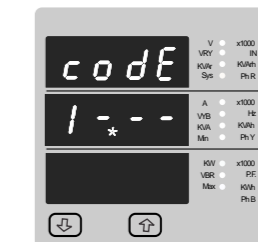


Enter Password, prompt for first digit. (* Denotes that decimal point will be flashing).

Press the "Down" key to scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the "Up" key to advance to next digit.

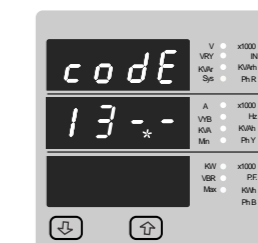
In the special case where the Password is "0000" pressing the "Up" key when prompted for the first digit will advance to the "Password Confirmed" screen.



Enter Password, first digit entered, prompt for second digit. (* Denotes that decimal point will be flashing).

Use the "Down" key to scroll the value of the second digit from 0 through to 9, the value will wrap from 9 round to 0.

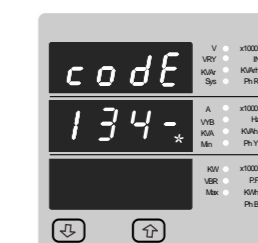
Press the "Up" key to advance to next digit.



Enter Password, second digit entered, prompt for third digit. (* Denotes that decimal point will be flashing).

Use the "Down" key to scroll the value of the third digit from 0 through to 9, the value will wrap from 9 round to 0.

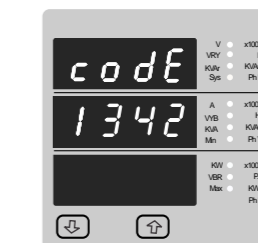
Press the "Up" key to advance to next digit.



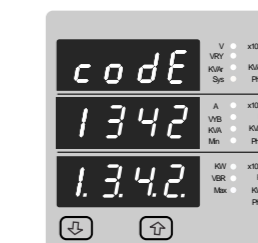
Enter Password, third digit entered, prompt for fourth digit. (* Denotes that decimal point will be flashing).

Use the "Down" key to scroll the value of the fourth digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the "Up" key to advance to verification of the password.

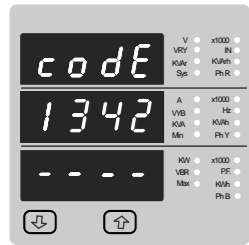


Enter Password, fourth digit entered, awaiting verification of the password.



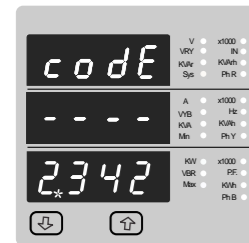
Password confirmed. Pressing "Down" key will advance to the "New / change Password" entry stage.

Pressing the "Up" key will advance to the Set up screen. (See section 3.2).



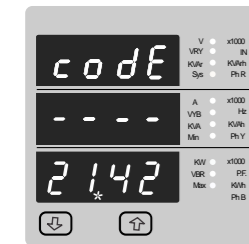
Password Incorrect.
The unit has not accepted the Password entered.
Pressing the "↓ Down" key will return to the Enter Password stage.

Pressing the "↑ Up" key exits the Password menu and returns operation to the measurement reading mode.



New / Change Password
(*Decimal point indicates that this will be flashing).
Pressing the "↓ Down" key will scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0.

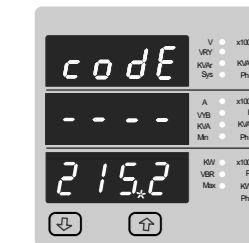
Pressing the "↑ Up" key to advance the operation to the next digit and sets the first digit, in this case to '2'



New / Change Password, first digit entered, prompting for second digit. (*Decimal point indicates that this will be flashing).

Pressing the "↓ Down" key will scroll the value of the second digit from 0 through to 9, the value will wrap from 9 round to 0.

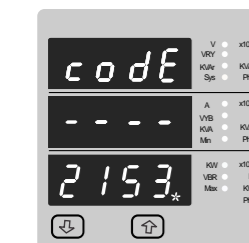
Pressing the "↑ Up" key to advance the operation to the next digit and sets the second digit, in this case to '1'



New / Change Password, second digit entered, prompting for third digit. (*decimal point indicates that this will be flashing).

Pressing the "↓ Down" key will scroll the value of the third digit from 0 through to 9, the value will wrap from 9 round to 0.

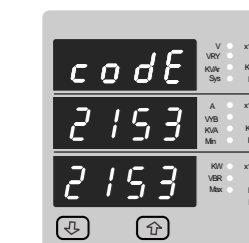
Pressing the "↑ Up" key to advance the operation to the next digit and sets the third digit, in this case to '5'



New / Change Password, third digit entered, prompting for fourth digit. (* denotes that decimal point will be flashing).

Pressing the "↓ Down" key will scroll the value of the fourth digit from 0 through to 9, the value will wrap from 9 round to 0.

Pressing the "↑ Up" key to advance the operation to the "New Password Confirmed" and sets the fourth digit, in this case to '3'.



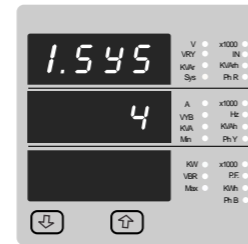
New Password confirmed.

Pressing the "↓ Down" key will return to the "New/Change Password".

Pressing the "↑ Up" key will advances to the Set up screen.(see section 3.2).

3.2 Set Up Screens

3.2.1. System Type



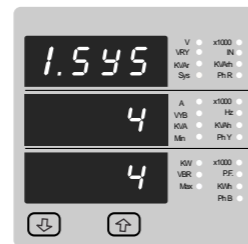
This screen is used to set the system type .
System type '3' for 3 phase 3 wire & '4' for 3 phase 4 wire system.

Pressing the "↑ Up" key accepts the present value and advances to the "Potential transformer primary value Edit" menu (see section 3.2.2)

Pressing the "↓ Down" key will enter the system type edit mode and scroll the values through values available .

Pressing the "↑ Up" key advances to the system type confirmation menu.

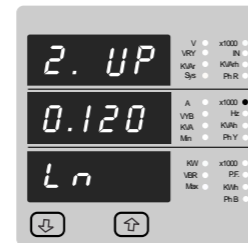
System Type Confirmation



This screen will only appear following the edit of system type. If system type is to be Downed again, pressing the "↓ Down" key will return to the system type edit stage by blanking the bottom line of the display pressing the "↑ Up" key sets the displayed value and will advance to "Potential Transformer Primary Value Edit" menu. (See section 3.2.2)

3.2.2. Potential Transformer Primary Value

The nominal full scale voltage which will be displayed as the L1-N, L2-N and L3-N for a four wire (Ln) system or as L1-2, L2-3 and L3-1 in a three wire(LL) system. This screen enables the user to display the line to neutral and line to line voltages inclusive of any transformer ratios, the values displayed represent the voltage in kilovolts (note the x1000 enunciator).

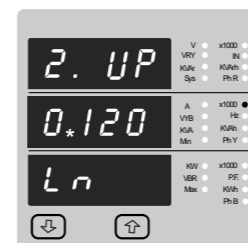


Pressing the "↑ Up" key accepts the present value and advances to the "Current Transformer Primary Value edit" menu. (See Section 3.2.3)

Pressing the "↓ Down" key will enter the "Potential Transformer Primary Value Edit" mode.

Initially the "multiplier must be selected, pressing the " Down" key will move the decimal point position to the right until it reaches # # # # after which it will return to # # # #.

Pressing the "↑ Up" key accepts the present multiplier (decimal point position) and advances to the "Potential Transformer Digit Edit" mode.



Potential Transformer Digit Edit

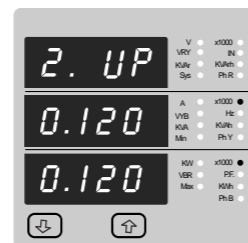
Pressing the "↓ Down" key will scroll the value of the most significant digit from 0 through to 9 unless the presently displayed Potential Transformer Primary Value together with the Current Transformer Primary Value, previously set, would result in a maximum power of greater than 1000 MVA per phase in that case the digit range will be restricted.

Pressing the "↑ Up" key accepts the present value at the cursor position and advances the cursor to the next less significant digit.

Note : the flashing decimal point indicates the cursor position, a steady decimal point will be present to identify the scaling of the number until the cursor position coincides with the steady decimal point position. At this stage the decimal point will flash.

When the least significant digit has been set pressing the "↑ Up" key will advance to the "Potential Transformer Primary Value Confirmation" stage.

Screen showing display of 0.120 kV i.e. 120 Volts indicating steady decimal point and cursor flashing at the "hundreds of volts" position.



Note : 0.120 kV i.e. 120 V_{L-N} for 4W
120 V_{L-L} for 3W

Potential Transformer Primary Value Confirmation

This screen will only appear following an edit of the Potential Transformer Primary Value.

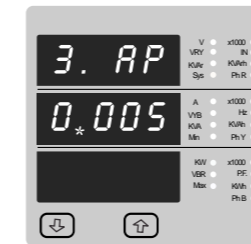
If the scaling is not correct, pressing the "↓ Down" key will return to the "Potential Transformer Primary Value Edit" stage with the digits flashing indicating that the multiplier (decimal point position) should be selected.

Pressing the "↑ Up" key sets the displayed value and will advance to the Current Transformer Primary Value (See section 3.2.3.)

3.2.3. Current Transformer Primary Value

The nominal Full Scale Current that will be displayed as the Line currents. This screen enables the user to display the Line currents inclusive of any transformer ratios, the values displayed represent the Current in Amps.

Pressing the "↑ Up" key accepts the present value and advances to the Current Transformer Secondary Value (See section 3.2.4)



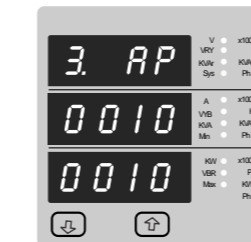
Pressing the "↓ Down" key will enter the "Current Transformer Primary Value Edit" mode. This will scroll the value of the most significant digit from 0 through to 9, unless the presently displayed Current Transformer Primary Value together with the Potential Transformer Primary Value results in a maximum power of greater than 1000 MVA in which case the digit range will be restricted, the value will wrap. Example: If primary value of PT is set as 400kV (max value) then primary value of Current is restricted to 1736A.

Pressing the "↑ Up" key will advance to the next less significant digit. (* Denotes that decimal point will be flashing).

The "Maximum Power" restriction of 1000 MVA refers to 120% of nominal current and 120% of nominal voltage, i.e. 694.4 MVA nominal power per phase.

When the least significant digit had been set, pressing the "↑ Up" key will advance to the "Current Transformer Primary Value Confirmation" stage.

The minimum value allowed is 1, the value will be forced to 1 if the display contains zero when the "↑ Up" key is pressed.



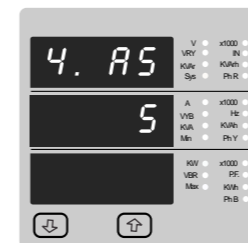
Current Transformer Primary Value Confirmation.

This screen will only appear following an edit of the Current Transformer Primary Value.

If the scaling is not correct, Pressing the "↓ Down" key will return to the "Current Transformer Primary Value Edit" stage with the most significant digit highlighted (associated decimal point flashing) and the bottom line of the display will be blanked.

Pressing the "↑ Up" key sets the displayed value and will advance to the "Current Transformer Secondary Value Edit" menu. (See section 3.2.4).

3.2.4. Current Transformer Secondary Value



This screen is used to set the secondary value for Current Transformer. Secondary value "5" for 5A or "1" for 1A can be selected. Pressing "↑ Up" key accepts the present value and advances to the Energy Display on Modbus Menu (See section 3.2.5).

Pressing the "↓ Down" key will enter the CT Secondary value edit mode and scroll the value through the values available.

Pressing the "↑ Up" key will advance to the CT Secondary value confirmation.

CT Secondary value confirmation

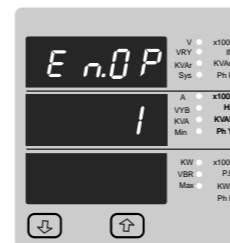
This screen will only appears following an edit of CT secondary value .

If secondary value shown is not correct, pressing the Down key will return to CT secondary edit stage by blanking the bottom line of the display.

Pressing "↑ Up" key sets the displayed value and will advance to Energy Display on Modbus menu. (See section 3.2.5)

3.2.5. Energy Display on modbus

This screen enable user to set energy in terms of Wh / KWh / MWh on RS 485 Output depending as per the requirement .Same applicable for all types of energy.

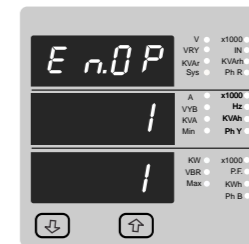


Pressing "↑ Up" key accepts the presents value and advances to the Reset menu (See section 3.2.6).

Pressing the "↓ Down" key will enter the "Energy Display On Modbus Edit" mode and scroll the value through the values 1,2 & 3 wrapping back to 1

- 1 : Energy In Wh
- 2 : Energy In KWh
- 3: Energy in MWh.

Pressing the "↑ Up" key advances to the Reset menu (See section 3.2.6).



Energy Display On Modbus Confirmation.

This screen will only appear following an edit of the Energy Display On Modbus.

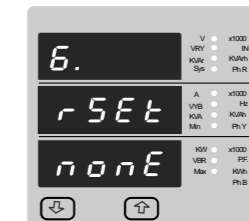
Pressing the "↓ Down" key will enter the "Energy Display On Modbus Edit" stage by blanking the bottom line of the display.

Pressing "↑ Up" key sets the displayed value and will advance to the Reset menu (See section 3.2.6).

Note : Default value is set to '1' i.e. Energy on Modbus will be in terms of Wh/Varh/VAh/Ah resp.

3.2.6. Reset

The following screens allow the users to reset the all Energy , Lo(Min), hi(Max) .

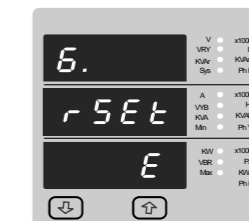


Reset (None)

Pressing "↑ Up" key advances to Modbus address set menu. (see section 3.2.7).

Pressing the "↓ Down" key will enter the "Reset option" mode and scroll the value" through the option and wrapping back to None.

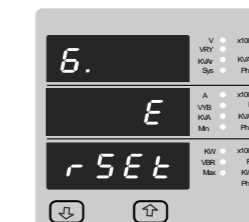
Pressing "↑ Up" key will not reset and will advance to Modbus address set menu.(See sec.3.2.7)



Reset option select, (Reset Energy)

The user has scrolled through to the "E" Energy value.

Pressing "↑ Up" key will select the value and advance to the "Reset Energy Confirmation" Mode.



Reset Energy Confirmation.

Pressing the "↓ Down" key will re-enter the "Reset option" mode.

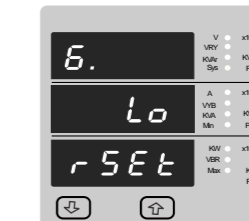
Pressing "↑ Up" key resets the all Energy parameters and advances to the Modbus address set (see section 3.2.7.)



Reset option select, (Reset Lo)

The user has scrolled through to the "Lo" (Min)

Pressing "↑ Up" key will select the value and advance to the "Reset Lo Confirmation" Mode.



Reset Lo Confirmation

Pressing the "↓ Down" key will re-enter the "Reset option Select mode.

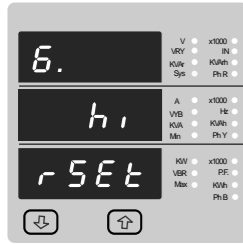
Pressing "↑ Up" key resets the Lo (Min) readings and advances to Modbus Address set menu (see section 3.2.7).



Reset option select, (Reset Hi)

The user has scrolled through to the "Hi" (Max)

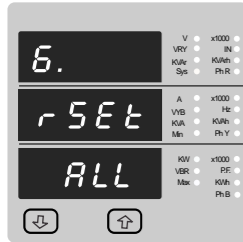
Pressing "↑ Up" key will select the value and advance to the "Reset Hi Confirmation" Mode.



Reset hi (Max) Confirmation.

Pressing the "Down" key will re-enter the "Reset option Select mode."

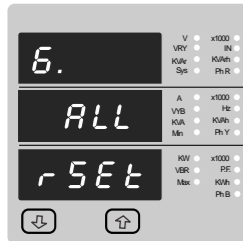
Pressing "Up" key resets the hi (Max) readings and advances to Modbus address set menu (see section 3.2.7).



Reset option select, (Reset ALL)

The user has scrolled through to the "ALL".

Pressing "Up" key will select the value and advance to the "Reset ALL Confirmation" Mode.

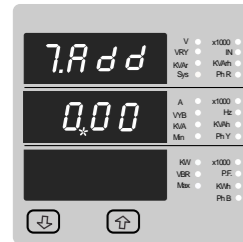


Reset ALL Confirmation.

Pressing the "Down" key will re-enter the "Reset option Select mode."

Pressing "Up" key resets ALL the readings and advances to the Modbus address set menu (see section 3.2.7).

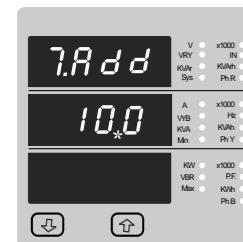
3.2.7 Address Setting : This screen applies to the RS 485 output only. This screen allows the user to set RS485 address for instruments



The range of allowable address is 1 to 247.

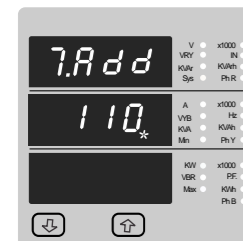
Enter Address, prompt for first digit. (* Denotes that decimal point will be flashing).

Press the "Down" key to scroll the value of the first digit. Press the "Up" key to advance to next digit.



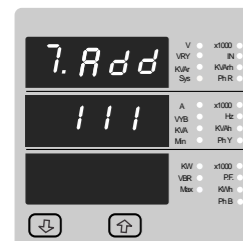
Enter Address, first digit entered, prompt for second digit (* Denotes that decimal point will be flashing).

Use the "Down" key to scroll the value of the second digit. Press the "Up" key to advance to next digit.



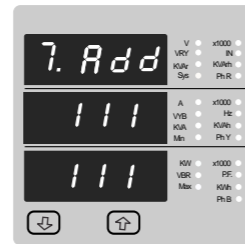
Enter Address, second digit entered, prompt for third digit (* Denotes that decimal point will be flashing).

Use the "Down" key to scroll the value of the third digit



Enter Address for third digit.

Press the "Up" key to advance to Address confirmation Screen.



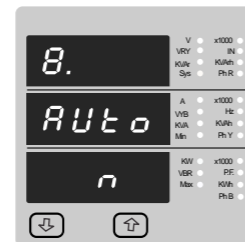
Address confirmation Screen.

This Screen confirms the Address set by user.

Press the "Up" key to advance to next Screen "Auto Scrolling" (3.2.8)

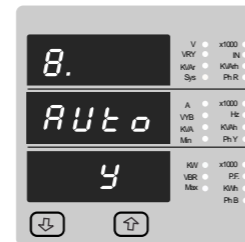
3.2.8 Auto Scrolling :

This screen allows user to enable screen scrolling.



Auto scrolling Edit.

Pressing "Up" key accepts the present status and advance to the Low Current noise cutoff (see section 3.2.9).

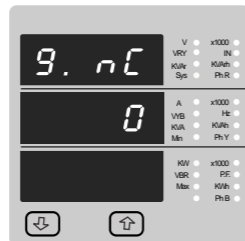


Pressing the "Down" key will enter the "Auto Screen Scrolling Edit" and toggle the status 'Yes' and 'No'.

Pressing the "Up" key will select the status displayed and advance to the Low Current noise cutoff (see section 3.2.9).

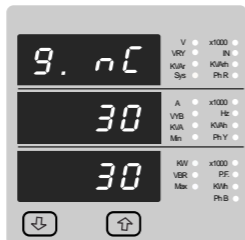
3.2.9. Low Current noise cutoff.

This screen allows the user to set Low noise current cutoff in mA.



Low current cutoff Edit.

Pressing "Up" key accepts the present value and advance to Modbus baud rate setting



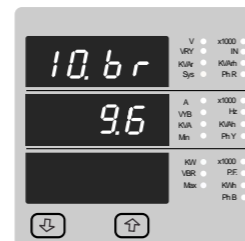
Low current noise cutoff Confirmation.

pressing the "Down" key will re-enter the "Low current Noise cutoff Edit" mode.

Pressing "Up" key set displayed value and will advance to Modbus baud rate setting. (See section 3.2.10)

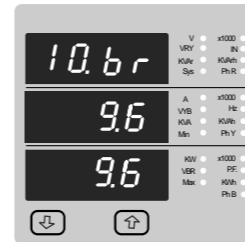
3.2.10 RS 485 Baud Rate :

This screen allows the user to set Baud Rate of RS 485 port. The values displayed on screen are in kbaud.



Pressing "Up" key accepts the present value and advance to the Parity Selection (see section 3.2.11).

Pressing the "Down" key will enter the "Baud Rate Edit" mode and scroll the value through 2.4, 4.8, 9.6, 19.2 and back to 2.4



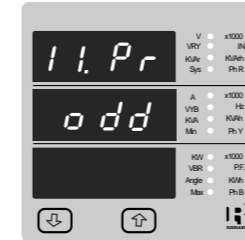
RS 485 Baud Rate confirmation :

Pressing "Down" key will be re-enter into Baud Rate Edit mode.

Pressing the "Up" key will select the value and advances to the Parity Selection (see section 3.2.11).

3.2.11 RS 485 Parity Selection :

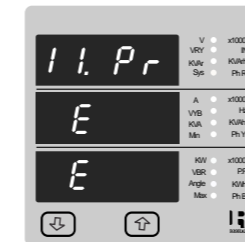
This screen allows the user to set Parity & number of stop bits of RS 485 port.



Pressing "Up" key accepts the present value and will advance to Energy Digit Rollover (reset) count setting screen(See section 3.2.12).

Pressing the "Down" key will enter the "Parity & stop bit Edit" mode and scroll the value through

- odd : odd parity with one stop bit
- no 1 : no parity with one stop bit
- no 2 : no parity with two stop bit
- E : even parity with one stop bit

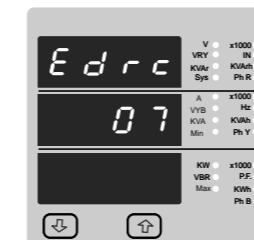


RS 485 Parity confirmation :

Pressing "Down" key will be re-enter into Parity Edit mode.

Pressing "Up" key set displayed selected Parity and will advance to Energy Digit Rollover (reset) count setting screen (See section 3.2.12)

3.2.12 Energy Digit Rollover (reset) count :



This screen enables user for setting maximum energy count after which energy will rollback to zero depends upon setting of Wh,KWh, & MWh.

Pressing the "Up" key sets the displayed value and will exit from set up.

Pressing the "Down" key will enter the Energy digit reset count edit mode. This will scroll the value of reset count from 7 to 14 for Wh, from 7 to 12 for KWh & from 7 to 9 for MWh.

Ex. If energy display on modbus is set Wh & It will set Energy digit count to 10 then energy will reset after '9,999,999,999' & then will rollback to zero.

Pressing "Up" key will advance to Energy digit reset count confirmation screen.

Pressing the "Down" key will re-enter Energy digit reset count edit mode.

Pressing the "Up" key will set the value and exit from set up.

Note :

- 1) Default value is set to "14" i.e if energy count crosses 14 digit it will rollback to zero.
- 2) Energy displays on modbus is set to (2) & energy digit reset count is set to 12. Energy screen on display will show "-----" i.e Energy overflow .when energy crosses the 11 digit count.
- 3) Energy displays on modbus is set to (3) & energy digit reset count is set to 9. Energy screen on display will show "-----" i.e Energy overflow .when energy crosses the 8 digit count.

4. RS 485 (ModBus) Output :

The instrument supports MODBUS (RS485) RTU protocol(2-wire).

Connection should be made using twisted pair shielded cable. All "A" and "B" connections are daisy chained together. The screens should also be connected to the "Gnd" terminal. To avoid the possibility of loop currents, an Earth connection should be made at one point on the network. Loop (ring) topology does not require any termination load. Line topology may or may not require terminating loads depending on the type and length of cable used. The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 ohm (1/4 Watt min.) resistor.

RS 485 network supports maximum length of 1.2km. Including the Master, a maximum of 32 instruments can be connected in RS485 network. The permissible address range for Instrument is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time of an Instrument is 200ms approx. i.e. this is the amount of time that can pass before the first response character is output.

After sending any query through software (of the Master) , it must allow 200ms of time to elapse before assuming that the Instrument is not going to respond. If slave does not respond within 200 ms, Master can ignore the previous query and can issue fresh query to the slave.

The each byte in RTU mode has following format:

	8-bit binary, hexadecimal 0-9, A-F 2 hexadecimal characters contained in each 8-bit field of the message
Format of Data Bytes	4 bytes (32 bits) per parameter. Floating point format (to IEEE 754) Most significant byte first (Alternative least significant byte first)
Error Checking Bytes	2 byte Cyclical Redundancy Check (CRC)
Byte format	1 start bit, 8 data bits, least significant bit sent first 1 bit for even/odd parity 1 stop bit if parity is used; 1 or 2 bits if no parity

Communication Baud Rate is user selectable from the front panel between 2400, 4800, 9600, 19200 bps.

Register Addresses :

Two consecutive 16 bit registers represent one parameter. Refer table below for the addresses of 3X registers and addresses for the parameters measured by the instruments.

Accessing 3 X register for reading measured values: Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters. 1 Word =16 bit register

To read parameter

1) Volts 3: Start address= 04 (Hex) No of words = 02

2) Current 3: Start address = 0A (Hex) No of words = 02

Each Query for reading the data must be restricted to 40 parameters or less. Exceeding the 40 parameter limit will cause a ModBus exception code to be returned.

Table : for Reading the Measured Parameters from Instrument

Address (Register)	Parameter No.	Parameter	Modbus Start Address Hex		3P 4W	3P 3W
			High Byte	Low Byte		
30001	1	Volts 1	00	0	✓	✓
30003	2	Volts 2	00	2	✓	✓
30005	3	Volts 3	00	4	✓	✓
30007	4	Current 1	00	6	✓	✓
30009	5	Current 2	00	8	✓	✓
30011	6	Current 3	00	A	✓	✓
30013	7	W1	00	C	✓	X
30015	8	W2	00	E	✓	X
30017	9	W3	00	10	✓	X
30019	10	VA1	00	12	✓	X
30021	11	VA2	00	14	✓	X
30023	12	VA3	00	16	✓	X
30025	13	VAR1	00	18	✓	X
30027	14	VAR2	00	1A	✓	X
30029	15	VAR3	00	1C	✓	X
30031	16	PF1	00	1E	✓	X
30033	17	PF2	00	20	✓	X
30035	18	PF3	00	22	✓	X
30037	19	-----	00	24	----	----
30039	20	-----	00	26	----	----
30041	21	-----	00	28	----	----
30043	22	Volts Ave	00	2A	✓	✓
30045	23	Volts Sum	00	2C	✓	✓
30047	24	Current Ave	00	2E	✓	✓
30049	25	Current Sum	00	30	✓	✓
30051	26	Watts Ave	00	32	✓	✓
30053	27	Watts Sum	00	34	✓	✓
30055	28	VA Ave	00	36	✓	✓
30057	29	VA Sum	00	38	✓	✓
30059	30	VAR Ave	00	3A	✓	✓
30061	31	VAR Sum	00	3C	✓	✓
30063	32	PF Ave	00	3E	✓	✓
30065	33	PF Sum	00	40	✓	X
30067	34	-----	00	42	----	----
30069	35	-----	00	44	----	----
30071	36	Freq	00	46	✓	✓
30073	37	Watt Hour	00	48	✓	✓
30075	38	-----	00	4A	----	----
30077	39	VAR Hour	00	4C	✓	✓
30079	40	-----	00	4E	----	----
30081	41	VAh	00	50	✓	✓
30133	67	Volts Ave Max	00	84	✓	✓
30135	68	Volts Ave Min	00	86	✓	✓
30141	71	Current Ave Max	00	8C	✓	✓
30143	72	Current Ave Min	00	8E	✓	✓
30201	101	VL 1 - 2 (Calculated)	00	C8	✓	X
30203	102	VL 2 - 3 (Calculated)	00	CA	✓	X
30205	103	VL 3 - 1 (Calculated)	00	CC	✓	X
30225	113	I neutral	00	E0	✓	X

Note : Parameters 1,2,3 are L-N Voltage for 3P 4W & L-L Voltage for 3P 3W .

Function code :

03	Read Holding Registers	Read content of read /write location (4X)
04	Read input Registers	Read content of read only location (3X)
16	Presets Multiple Registers	Set the content of read / write locations (4X)

Exception Cases : An exception code will be generated when instrument receives ModBus query with valid parity & error check but which contains some other error (e.g. Attempt to set floating point variable to an invalid value) The response generated will be "Function code" ORed with HEX (80H). The exception codes are listed below

01	Illegal function	The function code is not supported by instrument.
02	Illegal Data Address	Attempt to access an invalid address or an attempt to read or write part of a floating point value
03	Illegal Data Value	Attempt to set a floating point variable to an invalid value

Accessing 4 X register for Reading & Changing the setting inside instrument:
Each setting is held in the 4X registers .ModBus code 03 is used to read the current setting and code 16 is used to write/change the setting.

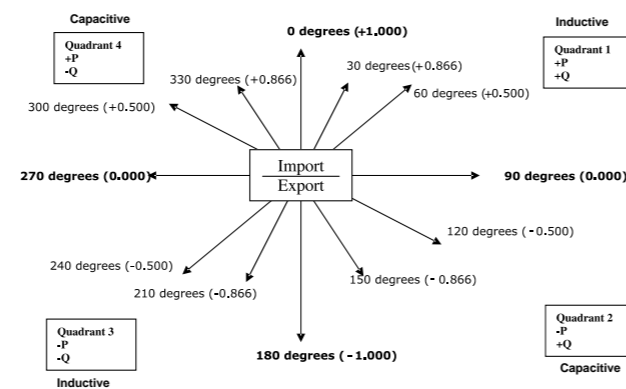
Address (Register No.)	Parameter No.	Parameter	Read / Write	Modbus Start Address High Byte	Modbus Start Address Low Byte
40005	3	Energy display on Modbus	Read / Write	00	04
40007	4	Sys Voltage	Read only	00	06
40009	5	Sys Current	Read only	00	08
40011	6	Sys Type	Read / Write	00	0A
40013	7	----	----	----	----
40015	8	Energy Reset	Write only	00	0E
40021	11	Mod Addr.	Read only	00	14
40023	12	----	----	----	----
40025	13	Min Reset	Write only	00	18
40027	14	Max Reset	Write only	00	1A
40029	15	----	----	----	----
40031	16	----	----	----	----
40037	19	Sys Power	Read Only	00	24
40039	20	Energy digit Rollover(reset) count	Read / Write	00	26
40041	21	Word Order	Write Only	00	28

Explanation for 4 X register :

Address	Parameter	Description
40005	Energy display on Modbus	This address is used to set energy display on modbus in Wh, KWh & MWh. Write one of the following value to this address. 1 = Energy in Wh. 2 = Energy in KWh. 3 = Energy in MWh.
40007	System Voltage	This address is read only and displays System Voltage
40009	System Current	This address is read only and displays System Current
40011	System Type	This address is used to set the System type. Write one of the following value to this address. 2 = 3 Phase 3 Wire 3 = 3 Phase 4 Wire. Writing any other value will return error .
40013	----	----
40015	Reset Energy Counter	This address is used to reset the Energy Counter. Write zero value to this register to reset the energy counter. Writing any other value will return an error.
40021	Instrument Address	This address is read only & display instrument address between 1 to 247 .
40023	----	----
40025	Min - Reset	This address is used to reset the Min parameters value. Write Zero value to this register to reset the Min parameters. Writing any other value will return an error.
40027	Max - Reset	This address is used to reset the Max parameters value. Write Zero value to this register to reset the Max parameters. Writing any other value will return an error.
40029	----	----
40031	----	----
40037	Sys Power	System Power is the maximum system power based on the values of system type, system volts and system current.
40039	Energy digit Reset Count	This address is used to setting maximum energy count after which energy will rollback to zero depends upon setting of Wh, KWh, & MWh. If Energy display on modbus in Wh count will be set in between 7 to 14 or In KWh set in between 7 to 12 & In MWh set in between 7 to 9.
40041	Word Order	Word Order controls the order in which instrument receives or sends floating - point numbers:- normal or reversed register order . In normal mode, the two registers that make up a floating point numbers are sent most significant bytes first. In reversed register mode , the two registers that make up a floating point numbers are sent least significant bytes first. To set the mode, write the value '2141.0' into this register- the instrument will detect the order used to send this value and set that order for all ModBus transaction involving floating point numbers.

5. Phasor Diagram : Refer the diagram for explanation

Quadrant 1: 0° to 90°
Quadrant 2: 90° to 180°
Quadrant 3: 180° to 270°
Quadrant 4: 270° to 360°



Connections	Quadrant	Sign of Active Power (P)	Sign of Reactive Power (Q)	Sign of Power Factor (PF)	Inductive / Capacitive
Import	1	+ P	+ Q	+	L
Import	4	+ P	- Q	+	C
Export	2	- P	+ Q	-	C
Export	3	- P	- Q	-	L

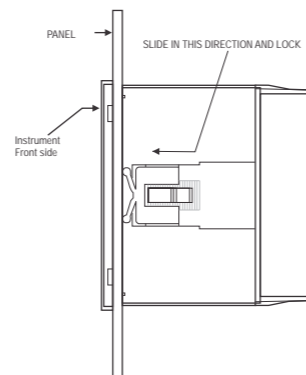
Inductive means Current lags Voltage
Capacitive means Current leads Voltage

The instrument displays Active power (P) with " + " (positive sign) , the connection is " **Import** " .

When instrument displays Active power (P) with " - " (negative sign) , the connection is " **Export** " .

6. Installation

Mounting is by four side clamps, slide the side clamps through side slot till side clamp gets firmly locked in a groove (Refer fig.) Consideration should be given to the space required behind the instrument to allow for bends in the connection cables.



As the front of the enclosure conforms to IP54 it is protected from water spray from all directions, additional protection to the panel may be obtained by the use of an optional panel gasket. The terminals at the rear of the product should be protected from liquids.

The instrument should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range -10 to 55°C . Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

Caution

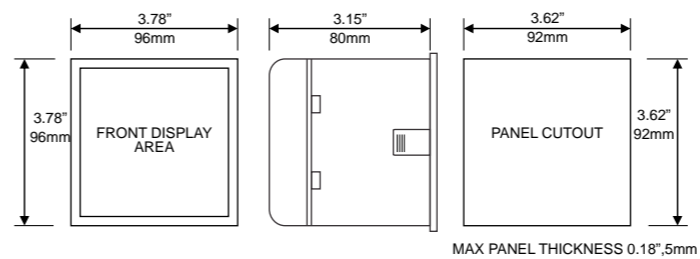
- In the interest of safety and functionality this product must be installed by a qualified engineer, abiding by any local regulations.**
- Voltages dangerous to human life are present at some of the terminal connections of this unit. Ensure that all supplies are de-energised before attempting any connection or disconnection.**
- These products do not have internal fuses therefore external fuses must be used to ensure safety under fault conditions.**

6.1 EMC Installation Requirements

This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

- Screened output and low signal input leads or have provision for fitting RF suppression components, such as ferrite absorbers, line filters etc., in the event that RF fields cause problems.
- Avoid routing leads alongside cables and products that are, or could be, a source of interference.
- To protect the product against permanent damage, surge transients must be limited to 2kV pk. It is good EMC practice to suppress differential surges to 2kV at the source. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.
The Current inputs of these products are designed for connection in to systems via Current Transformers only, where one side is grounded.
- ESD precautions must be taken at all times when handling this product.

6.2 Case Dimension and Panel Cut Out



6.3 Wiring

Input connections are made directly to screw-type terminals with indirect wire pressure. Numbering is clearly marked in the plastic moulding. Choice of cable should meet local regulations. Terminal for both Current and Voltage inputs will accept upto 3mm² x 2 diameter cables.

Note : It is recommended to use wire with lug for connection with meter.

6.4 Auxiliary Supply

The instrument should ideally be powered from a dedicated supply, however it may be powered from the signal source, provided the source remains within the limits of the chosen auxiliary voltage.

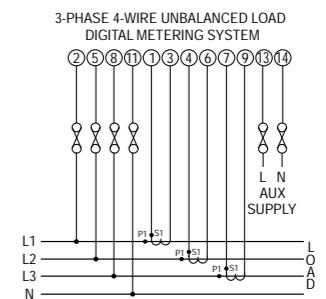
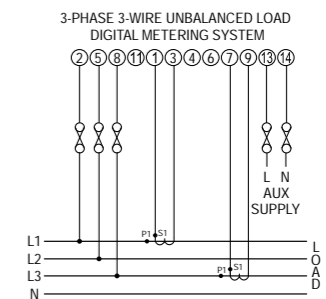
6.5 Fusing

It is recommended that all voltage lines are fitted with 1 amp HRC fuses.

6.6 Earth/Ground Connections

For safety reasons, CT secondary connections should be grounded in accordance with local regulations.

7. Connection Diagrams



8. Specification :

System

3 Phase 3 Wire / 4 Wire programmable at site

Inputs

Nominal input voltage (Three wire and Four wire) 57.7 V_{L-N} to 277V_{L-N} (100V_{L-L} to 480 V_{L-L})

Max continuous input voltage 120% of Rated Value

Max short duration input voltage 2 x Rated Value (1s application repeated 10 times at 10s intervals)

Nominal input voltage burden 0.2VA approx. per phase

Nominal input current 1A / 5A AC rms programmable at site

Max continuous input current 120% of Rated Value

Nominal input current burden 0.6VA approx. per phase

Max short duration current input 20 x Rated Value (1s application repeated 5 times at 5 min. intervals)

System CT primary values Std. Values upto 4kA (1 or 5 Amp secondaries)

Auxiliary

Standard nominal Auxillary supply voltages & Frequency 110V AC/50 Hz , 230V AC/50 Hz ,380V AC/50 Hz , 100 - 250V AC- DC, 12 - 48V DC

a.c. supply voltage tolerance +20 % / -15 % of Rated Value

a.c. supply frequency range 45 to 66 Hz

a.c. supply burden 4.5VA

d.c. supply burden 3W

Operating Measuring Ranges

Voltage 5 .. 120 % of Rated Value

Current 5 .. 120 % of Rated Value

Frequency 40 .. 70 Hz

Power Factor 0.8 Lag ... 1 ... 0.8 Lead

Accuracy

	Standard (CL 1.0)	Optional (CL 0.5) on request	Optional (CL 0.2) on request
Voltage	± 0.5 % of Range	± 0.5 % of Range	± 0.2 % of Range
Current	± 0.5 % of Range	± 0.5 % of Range	± 0.2 % of Range
Active Power	± 0.5 % of Range	± 0.5 % of Range	± 0.2 % of Range
Reactive Power	± 0.5 % of Range	± 0.5 % of Range	± 0.2 % of Range
Apparent Power	± 0.5 % of Range	± 0.5 % of Range	± 0.2 % of Range
Active Energy	± 1.0 %	± 0.5 %	± 0.2 %
Reactive Energy	± 1.0 %	± 0.5 %	± 0.2 %
Apparent Energy	± 1.0 %	± 0.5 %	± 0.2 %
Power Factor	± 1.0 % of Unity	± 1.0 % of Unity	± 0.5 % of Unity
Frequency	± 0.15 % of Mid Frequency		

Measurement error is much less than error specified above. Variation due to influence quantity is less than twice the error allowed for reference condition.

Reference conditions for Accuracy :

Reference temperature	23°C ± 2°C
Input frequency	50 or 60Hz ± 2%
Input waveform	Sinusoidal (distortion factor 0.005)
Auxiliary supply voltage	Rated Value ± 1 %
Auxiliary supply frequency	Rated Value ± 1 %
Power Factor	cos phi = 1 for Active power sin phi = 1 for Reactive power
Voltage	50%100% of Rated Value
Current	10%100% of Rated Value

Nominal range of use of influence quantities for measurands

Temperature	0 to 50°C
Auxiliary supply voltage	Rated Value ± 10 %
Auxiliary supply frequency	Rated Value ± 10 %
Temperature Coefficient (For Rated value range of use 0... 50°C)	0.025% / °C for Voltage (50..120% of Rated Value) 0.05% / °C for Current (10..120% of Rated Value)
Error change due to variation of an influence quantity	2 * Error allowed for the reference condition applied in the test.

Display

LED	3 line 4 digits . Digit height 11mm
Update	Approx. 1 seconds

Controls

User Interface	Two push buttons
----------------	------------------

Standards

EMC Immunity	IEC 61326 10V/m min-Level 3 industrial low level electromagnetic radiation environment IEC 61000-4-3.
Safety	IEC 61010-1 , Year 2001
IP for water & dust	IEC 60529

Isolation

Dielectric voltage withstand test between circuits and accessible surfaces	2.2 kV RMS 50 Hz for 1 minute between all electrical circuits
--	--

Environmental

Operating temperature	-10 to 55 °C
Storage temperature	-20 to +65°C
Relative humidity	0 .. 90 % RH
Warm up time	3 minute (minimum)
Shock	15g in 3 planes
Vibration	10 .. 55 Hz, 0.15mm amplitude
Enclosure (front only)	IP 54 as per IEC 60529

Enclosure

Style	96mm x 96mm DIN Quadratic
Material	Polycarbonate Housing , Self extinguish & non dripping as per UL 94 V-0
Terminals	Screw-type terminals
Depth	< 80 mm
Weight	0.620 kg Approx.

ModBus (RS 485) Option :

Protocol	ModBus (RS 485)
Baud Rate	19200 , 9600 , 4800 or 2400 (Programmable)
Parity	Odd or Even, with 1 stop bit, Or None with 1 or 2 stop bits

9. Connection for Optional RS 485 (modbus):

RS 485 (Modbus)

