# Operating Manual

## POWER \ PHASE ANGLE \ POWER FACTOR TRANSDUCER

## RISH CON - P




**IC :15001143**

**Rev.C - 12/10/26**

# POWER \ PHASE ANGLE \ POWER FACTOR TRANSDUCER
## Installation & Operating Instructions

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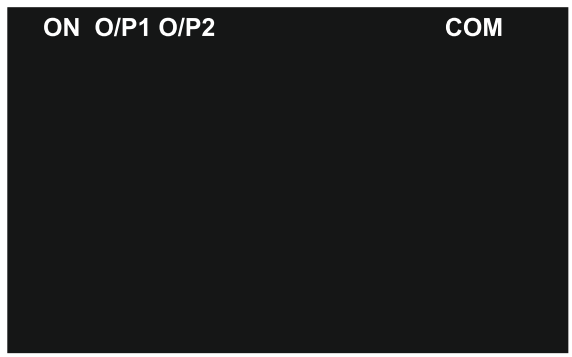
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# 1. Introduction

The **POWER \ PHASE ANGLE \ POWER FACTOR TRANSDUCER** is a DIN Rail /Wall mounted 78.5 X 65.5mm Transducer.
The Transducer is used to measure and convert Active, Apparent, Reactive Power, Phase Angle & Power Factor of a Single phase or Three phase AC System with balanced or unbalanced load into an proportional DC current or voltage output signal.




Transducer can be configured and programmed on site for the following :

PT Primary ,PT Secondary, CT Primary, CT Secondary, Input Characteristics (i.e start, end and elbow value of Input) and Output Characteristics (i.e Voltage or Current and start, end and elbow Value of outputs.)

## 1.1: LED Indication

| LED | LED OPERATING CONDITION | LED OPERATING STATUS |
|---|---|---|
| ON | Aux. Supply healthy condition | Green LED continuous ON |
| O/P 1 | Output1 Voltage<br>Output1 Current | Green LED continuous ON<br>Red LED continuous ON |
| O/P 2 | Output2 Voltage<br>Output2 Current | Green LED continuous ON<br>Red LED continuous ON |

## Table 1: Measured parameters

| Measured parameters | Unit of Measurement |
|---|---|
| Active Power | W |
| Reactive Power | VAr |
| Apparent Power | VA |
| Power Factor | – |
| Phase Angle | °(DEG) |

## 2. Programming

Programming of transducer can be done in two ways :

2.1. Programming Via Programming port available at front of Transducers using optional PRKAB601 Adapter.
2.2. Programming Via optional RS485(MODBUS)communication port.

### 2.1: Programming Via Programming port available at front of Transducers using optional PRKAB601 Adapter. .

For programming of Transducer, steps to be followed are

### Connections

PC → PRKAB 601 → Transducer.

The power supply must be applied to transducer before it can be programmed.

The Configuration software is supplied on a CD along with software help file .

The programming cable PRKAB601 adjusts the signal level and provides the electrical insulation between the PC and Transducers.

Configuration software can be used to program following parameters

1) PT Ratio.

2) CT Ratio.

3) RS485 Parameters.

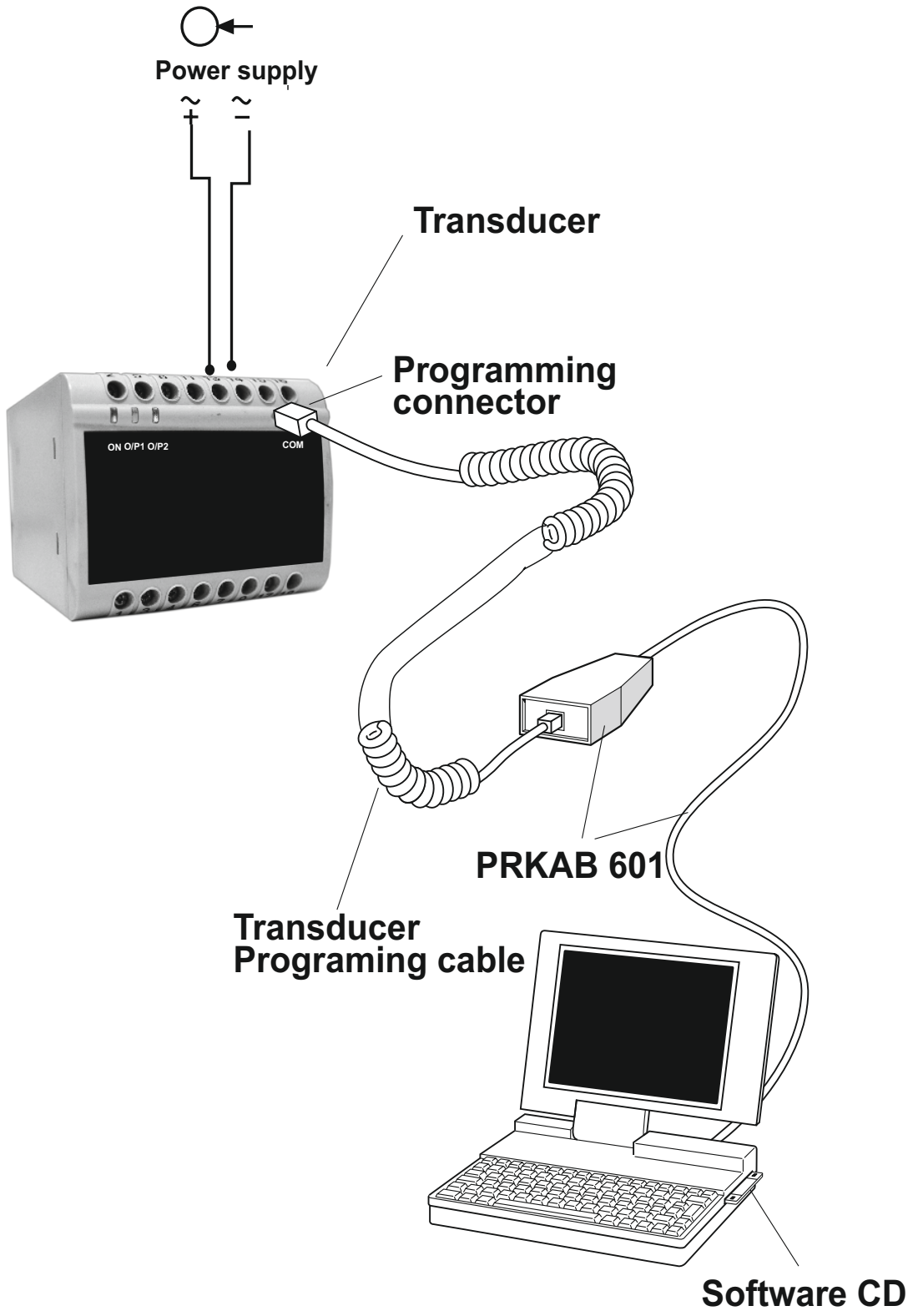
4) Transducer Type.

5) System Type.

6) Output Type (along with DIP switch setting).

7) Input Characteristics.

8) Output Characteristics.


Power supply
~
+
~
−
Transducer
Programming
connector
ON O/P1 O/P2
COM
PRKAB 601
Transducer
Programing cable
Software CD

## 2.2 Programming Via optional RS485 (MODBUS) communication port.

(Refer section 3 for programming through MODBUS)

### 2.2.1: DIP Switch Setting for Changing Output type

The Transducer output type can be changed from DC current to DC voltage depending upon user requirement on site.

To change output type user has to set the transducer output type parameter either to voltage or current along with DIP switch setting.

The transducer output type parameters can be configured using one of the two below given methods.

A) PRKAB 601(optional) : Using PRKAB601 through Transducer programming port (COM) and using PC based configuration software.

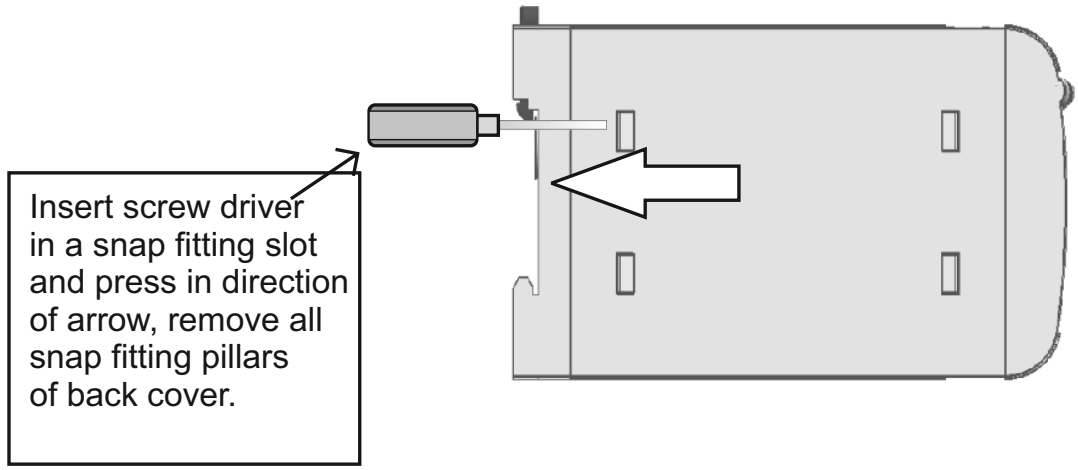
B) Modbus RS485(optional): Using modbus interface user can configure the output type refer modbus RS485 section.

**Note**: If DIP switch setting is done first and then output type parameter is configured using either of the above three methods then switch OFF -ON the Transducer.

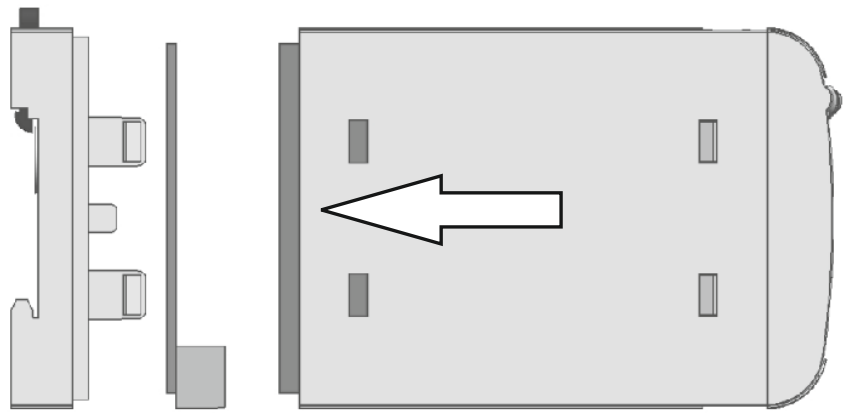
For changing DIP switches follow these steps

1) To change O/P switches from Current to Voltage or vice versa, ensure that transducer should be Electrically dead and all connection wires should be disconnected.

2) Remove the back cover of Transducer by using screw driver.



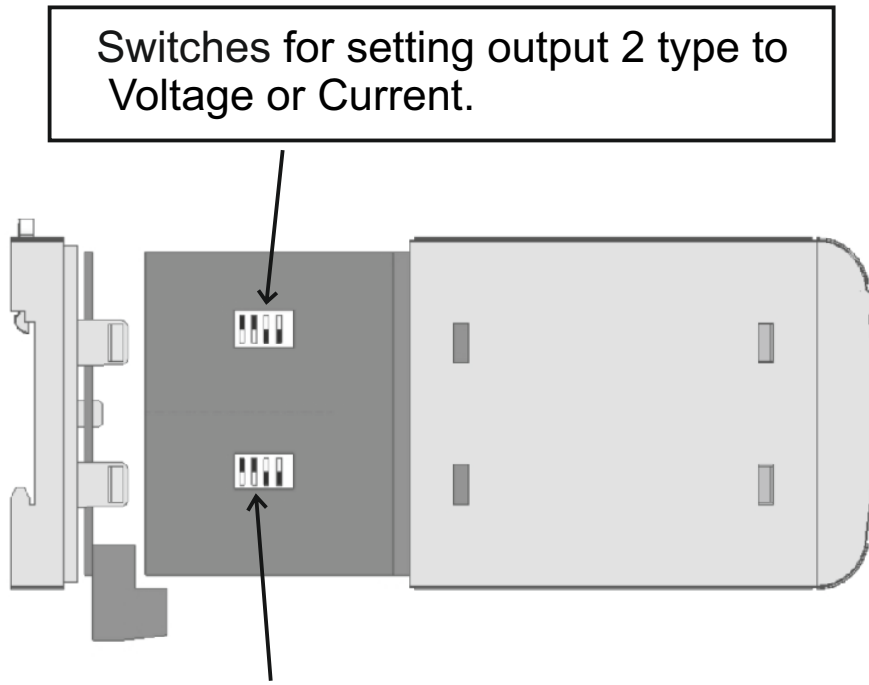

3) Remove the back cover and take the Output card out.



4) Configure the switches for Voltage or Current as shown below.

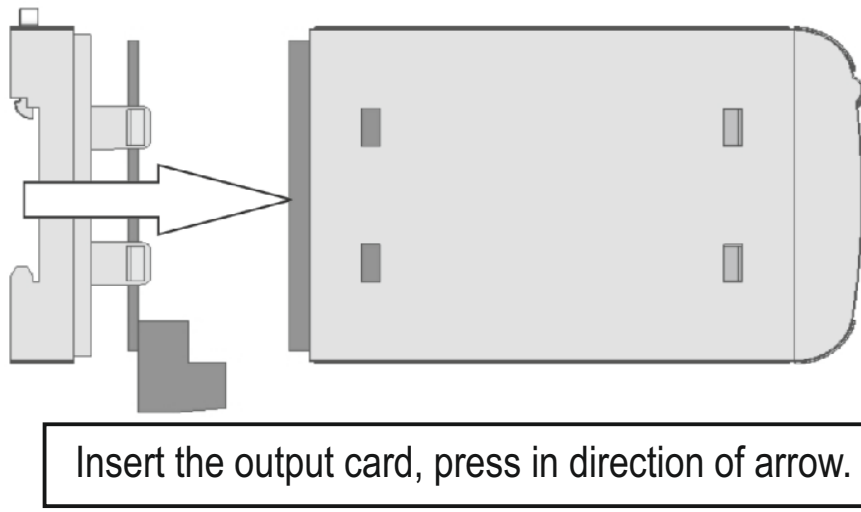
| DIP Switch Setting | Type of Output Signal |
|---|---|
|   | load-independent voltage |
|   | load-independent current |

**Note** :
Black portion in this diagram indicates switch position.

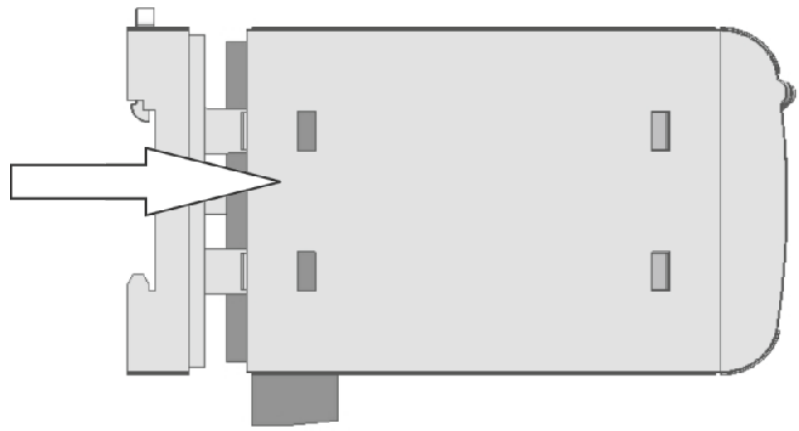



**NOTE:**
Black portion in above diagram indicate switch position.

5) After changing the switches for desired Output, Insert the Output Card.

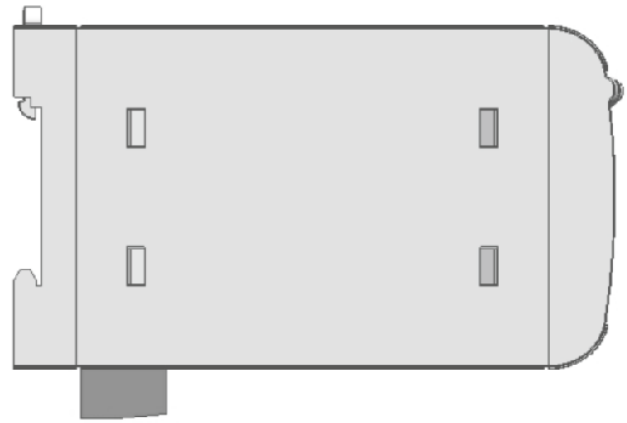


6) After inserting the output card insert the Interface card PCB and back cover.



Insert the Interface card PCB and Back cover, press in direction of arrow.

7) After inserting the Back cover of transducer, transducer is ready for required application.



## 3. RS 485 ( ModBus )

Transducer 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 Power Tranducer is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time of an Transducer is 200ms 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 200 ms of time to elapse before assuming that the Transducer 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<br>2 hexadecimal characters contained in each 8-bit field of the message |
| **Format of Data Bytes** | 4 bytes (32 bits) per parameter.<br>Floating point format ( to IEEE 754)<br>Most significant byte first (Alternative least significant byte first) |
| **Error Checking Bytes** | 2 byte Cyclical Redundancy Check (CRC) |

| | |
|---|---|
| **Byte format** | 1 start bit,<br>8 data bits, least significant bit sent first<br>1 bit for even/odd parity<br>1 stop bit if parity is used; 1 or 2 bits<br>if no parity |

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

**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 Transducer 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 Power Transducer. |
| 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 |

## 3.1: Accessing 3 X register for reading measured values:

Two consecutive 16 bit registers represent one parameter. Refer table 2 for the addresses of 3X registers (Parameters measured by the instruments).
Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters.

**Example :**

To read parameter,
Active power sum : Start address= 34 (Hex) Number of registers = 02

**Note : Number of registers = Number of parameters x 2**

Each Query for reading the data must be restricted to 20 parameters or less. Exceeding the 20 parameter limit will cause a ModBus exception code to be returned.

**Query :**

| 01 (Hex) | 04 (Hex) | 00 (Hex) | 34(Hex) | 00 (Hex) | 02(Hex) | 30 (Hex) | 05 (Hex) |
|---|---|---|---|---|---|---|---|
| Device Address | Function Code | Start Address High | Start Address Low | Number of Registers Hi | Number of Registers Lo | CRC Low | CRC High |

Start Address High : Most significant 8 bits of starting address of the parameter requested.
Start Address low : Least significant 8 bits of starting address of the parameter requested.
Number of register Hi : Most significant 8 bits of Number of registers requested.
Number of register Lo : Least significant 8 bits of Number of registers requested.

**(Note : Two consecutive 16 bit register represent one parameter.)**
**Response: Active Power Sum (4331 W)**

| 01 (Hex) | 04 (Hex) | 04 (Hex) | 45 (Hex) | 87 (Hex) | 68 (Hex) | B5 (Hex) | B0 (Hex) | D6 (Hex) |
|---|---|---|---|---|---|---|---|---|
| Device Address | Function Code | Byte Count | Data Register1 High Byte | Data Register1 Low Byte | Data Register2 High Byte | Data Register2 Low Byte | CRC Low | CRC High |

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

**(Note : Two consecutive 16 bit register represent one parameter.)**

## Table 2 : 3 X register addresses (measured parameters)

| Address (Register) | Parameter No. | Parameter | Modbus start address Hex | |
|---|---|---|---|---|
| | | | High Byte | Low Byte |
| For Active power | | | | |
| 30053 | 27 | Active power sum | 0 | 34 |
| For Apparent power | | | | |
| 30057 | 29 | Apparent power sum | 0 | 38 |
| For Reactive power | | | | |
| 30061 | 31 | Reactive power sum | 0 | 3C |
| For Power factor | | | | |
| 30063 | 32 | Power factor average | 0 | 3E |
| For Phase angle | | | | |
| 30067 | 34 | Phase angle average | 0 | 42 |

**For Diagnosis mode only:**

| Address (Register) | Parameter No. | Parameter | Modbus start address Hex | |
|---|---|---|---|---|
| | | | High Byte | Low Byte |
| 30001 | 1 | voltage 1 | 0 | 0 |
| 30003 | 2 | voltage 2 | 0 | 2 |
| 30005 | 3 | voltage 3 | 0 | 4 |
| 30007 | 4 | current 1 | 0 | 6 |
| 30009 | 5 | current 2 | 0 | 8 |
| 30011 | 6 | current 3 | 0 | 0A |
| 30043 | 22 | voltage average | 0 | 2A |
| 30047 | 24 | current average | 0 | 2E |
| 30071 | 36 | frequency | 0 | 46 |
| 30073 | 37 | VL1-2 | 0 | 48 |
| 30075 | 38 | VL2-3 | 0 | 4A |
| 30077 | 39 | VL3-1 | 0 | 4C |

## 3.2: Accessing 4 X register for Reading & Writing:

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. Refer **Table 3** for 4 X Register addresses.

**Example : Reading Device address**
Device address : Start address = 0E (Hex) Number of registers = 02
**Note :Number of registers = Number of Parameters x 2**

**Query :**

| | |
|---|---|
| Device Address | 01 (Hex) |
| Function Code | 03 (Hex) |
| Start Address High | 00 (Hex) |
| Start Address Low | 0E(Hex) |
| Number of Registers Hi | 00 (Hex) |
| Number of Registers Lo | 02 (Hex) |
| CRC Low | A5 (Hex) |
| CRC High | C8 (Hex) |

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

**(Note : Two consecutive 16 bit register represent one parameter.**)

## Response: Device address ( 1 )

| | |
|---|---|
| Device Address | 01 (Hex) |
| Function Code | 03 (Hex) |
| Byte Count | 04 (Hex) |
| Data Register1 High Byte | 3F (Hex) |
| Data Register1Low Byte | 80 (Hex) |
| Data Register2 High Byte | 00 (Hex) |
| Data Register2 Low Byte | 00(Hex) |
| CRC Low | F7 (Hex) |
| CRC High | CF (Hex) |

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

**(Note : Two consecutive 16 bit register represent one parameter.)**

## Table 3 : 4 X register addresses

| Address (Register) | Parameter No. | Parameter | Read / Write | Modbus Start Address Hex | |
|---|---|---|---|---|---|
| | | | | High Byte | Low Byte |
| 40001 | 1 | - | - | - | - |
| 40003 | 2 | Mode selection | R/Wp | 00 | 02 |
| 40005 | 3 | System Type | R/Wp | 00 | 04 |
| 40007 | 4 | PT Primary | R/Wp | 00 | 06 |
| 40009 | 5 | PT Secondary | R/Wp | 00 | 08 |
| 40011 | 6 | CT Primary | R/Wp | 00 | 0A |
| 40013 | 7 | CT Secondary | R/Wp | 00 | 0C |
| 40015 | 8 | Device address | R/Wp | 00 | 0E |
| 40017 | 9 | RS 485 Setup | R/Wp | 00 | 10 |
| 40019 | 10 | Password | R/Wp | 00 | 12 |
| 40021 | 11 | - | - | - | - |
| 40023 | 12 | - | - | - | - |
| 40025 | 13 | - | | | |

| Address (Register) | Parameter No. | Parameter | Read / Write | Modbus Start Address Hex | |
|---|---|---|---|---|---|
| | | | | High Byte | Low Byte |
| 40027 | 14 | Sim_Output A | Wp | 00 | 1A |
| 40029 | 15 | Sim_Output B | Wp | 00 | 1C |
| 40031 | 16 | Analog O/P Type 1 | R/Wp | 00 | 1E |
| 40033 | 17 | Output para select 1 | R/Wp | 00 | 20 |
| 40035 | 18 | Analog O/P Type 2 | R/Wp | 00 | 22 |
| 40041 | 19 | Diagonsis Mode | R/Wp | 00 | 28 |

## Explanation for 4 X register :

| Address | Parameter | Description |
|---|---|---|
| 40003 | Output Mode Selection | This is used to select the output mode. By setting output in simulation mode user can simulate the output variation without giving input. Normal mode = 1.<br>Simulation mode = 2.<br>**Note:** After power ON / OFF Transducer goes to normal mode |
| 40005 | System Type | This is used to select the system type.<br>**For Apparent / Active / Reactive Power Transducer**<br>1) 3 Phase 3 wire unbalanced = 3.<br>2) 3 Phase 4 wire unbalanced = 4.<br>3) Single Phase = 1.<br>4) 3 Phase 4 wire balanced = 8.<br>5) 3 Phase 3 wire balanced = 2.<br>**For Phase Angle or Power Factor Transducer**<br>1) U12 I1( 3 Phase 3 wire balanced) = 5.<br>2) U23 I1 ( 3 Phase 3 wire balanced) = 6.<br>3) U31 I1 ( 3 Phase 3 wire balanced) = 7. |

| Address | Parameter | Description |
|---|---|---|
| | | 4) Single Phase = 1.<br>5) 3 Phase 4 wire balanced = 8.<br>6) 3 Phase 3 wire balanced = 2. |
| 40007 | PT Primary | This address allows the user to read and write PT Primary value. The PT Primary value can be set between100 to 692.8 KVLL and also depends upon the per phase 1000 MVA Restriction of power combined with CT Primary. |
| 40009 | PT Secondary | This address is used to read and write the PT secondary value<br>in range between 100V to 500V L-L. |
| 40011 | CT Primary | This address allows the user to read and write CT Primary value.The maximum settable value is 9999 & also depends on the per phase 1000 MVA Restriction of power combined with PT primary. |
| 40013 | CT Secondary | This address is used to read and write the CT secondary value in range between 1A to 5A. |
| 40015 | Device Address | This address is used to set the Device Address between 1 to 247. |
| 40017 | RS 485 Setup | This address is used to set the Baud rate, Parity, No of Stop bits. |
| 40019 | Password | This address is used to set & reset the password. Valid Range of Password can be set is 0000 - 9999 .<br>1) if password lock is present & if this location is read it will return zero. |

| Address | Parameter | Description |
|---|---|---|
| | | 2) if pass word lock is absent & if this location is read it will return one.<br>3 )if password lock is present & to disable this lock first send valid password to this location then write "0000" to this location. |
| 40027 | Sim_Output A | This address is used to simulate output1. Analog Output 1 can be set to 10% by writing a value1000 and can be set to 100% by writing a value 10000.<br>**Note:** first transducers simulation mode is to be enable using address 40003. |
| 40029 | Sim_Output B | This address is used to simulate Output 2. Analog Output 2 can be set to 10% by writing a value1000 and can be set to 100% by writing a value 10000.<br>**Note:** first transducers simulation mode is to be enable using address 40003. |
| 40031 | Analog O/P Type 1 | This address is used to set the output 1 type as Voltage or Current.<br>Voltage = 1.<br>Current = 2. |
| 40033 | Output para Select | This address is used to set the Transducer type as<br>**1)** Active Power = 1.<br>**2)** Apparent Power = 2.<br>**3)** Reactive power = 3.<br>**4)** PF = 4.<br>**5)** Phase Angle = 5. |

| Address | Parameter | Description |
|---|---|---|
| | | **Note:** For system type 3Ph3W unbalance and 3Ph4W unbalance, transducer type such as PF and Phase angle are not applicable where as for system type U12 I1,U23 I1 and U31 I1,Transducer type such as Active power, Reactive power and Apparent power are not applicable. |
| 40035 | Analog O/P Type 2 | This address is used to set output 2 type as<br>Voltage/Current.<br>Voltage = 1.<br>Current = 2. |
| 40041 | Diagnosis Mode | This address is used to set transducer into the Diagonosis or Normal mode.<br>Normal mode = 0 Diagnosis mode =1.<br>**Note:** After power ON / OFF Transducer goes to normal mode |

**Table 4 : RS 485 Set-up Code**

| Baud Rate | Parity | Stop Bit | Decimal value |
|---|---|---|---|
| 19200 | NONE | 01 | 12 |
| 19200 | NONE | 02 | 13 |
| 19200 | EVEN | 01 | 14 |
| 19200 | ODD | 01 | 15 |
| 9600 | NONE | 01 | 08 |
| 9600 | NONE | 02 | 09 |
| 9600 | EVEN | 01 | 10 |

| Baud Rate | Parity | Stop Bit | Decimal value |
|---|---|---|---|
| 9600 | ODD | 01 | 11 |
| 4800 | NONE | 01 | 04 |
| 4800 | NONE | 02 | 05 |
| 4800 | EVEN | 01 | 06 |
| 4800 | ODD | 01 | 07 |
| 2400 | NONE | 01 | 00 |
| 2400 | NONE | 02 | 01 |
| 2400 | EVEN | 01 | 02 |
| 2400 | ODD | 01 | 03 |

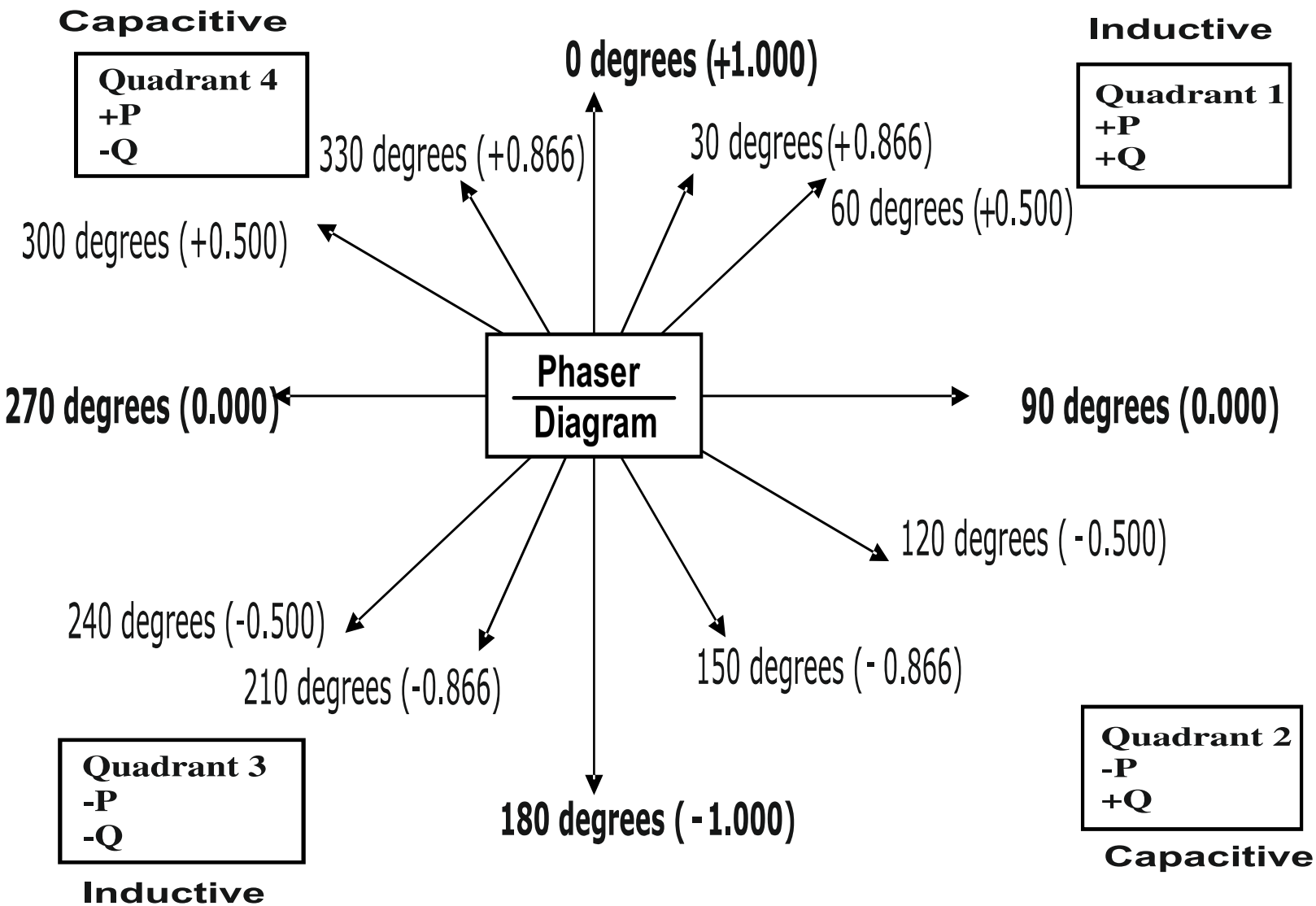
**Note :**
Codes not listed in the table above may give rise to unpredictable results including loss of communication. Exercise caution when attempting to change mode via direct Modbus writes.

## 4. Phaser Diagram :

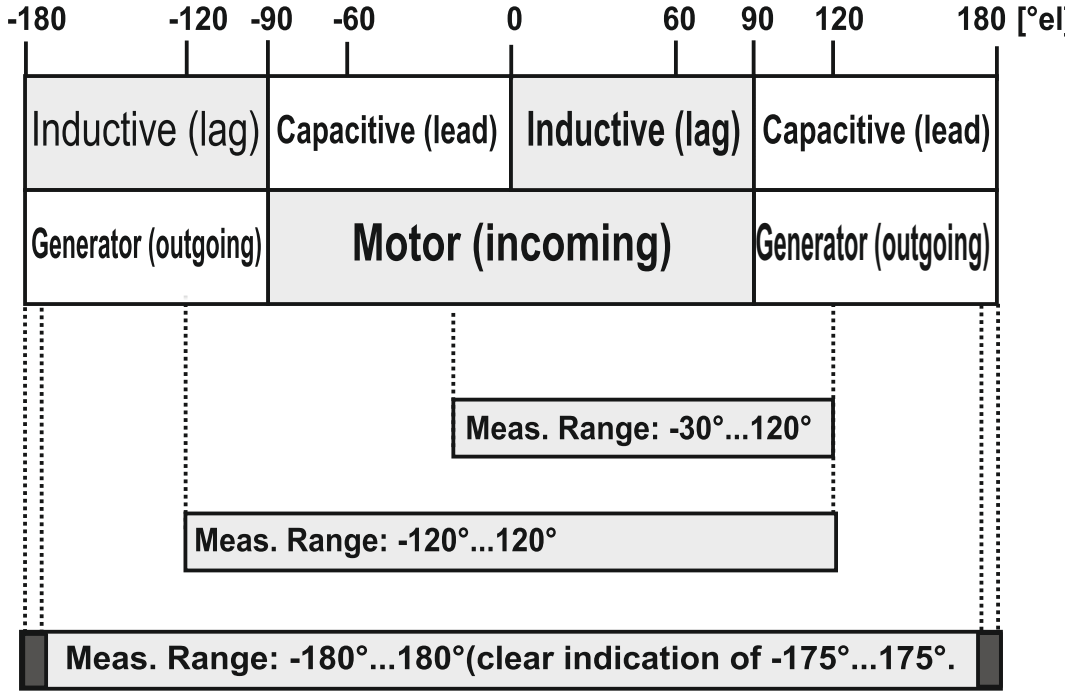
**Quadrant 1:** 0° to 90°  **Quadrant 3:** 180° to 270°
**Quadrant 2:** 90° to 180  **Quadrant 4:** 270° to 360°

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

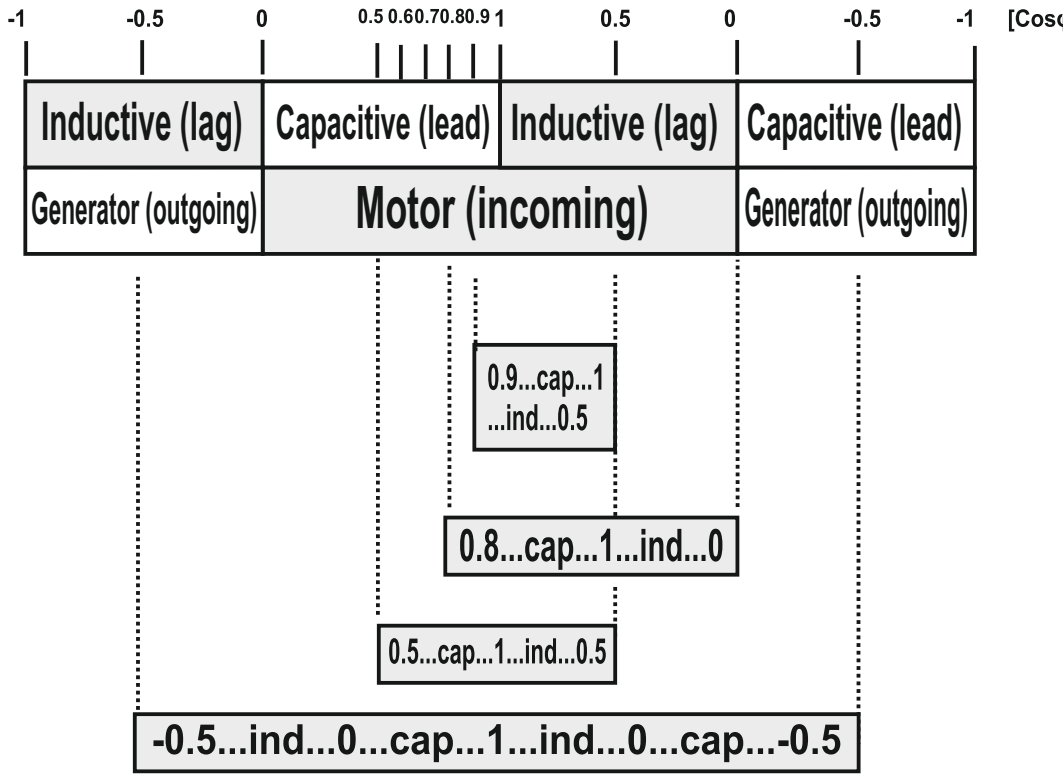
**Inductive means Current lags Voltage**
**Capacitive means Current leads Voltage**
Examples of measuring ranges with φ-linear output


Capacitive
Quadrant 4
+P
-Q
0 degrees (+1.000)
Inductive
Quadrant 1
+P
+Q
330 degrees (+0.866)
30 degrees (+0.866)
60 degrees (+0.500)
300 degrees (+0.500)
Phaser
Diagram
270 degrees (0.000)
90 degrees (0.000)
120 degrees ( - 0.500)
240 degrees (-0.500)
210 degrees (-0.866)
150 degrees ( - 0.866)
Quadrant 3
-P
-Q
180 degrees ( - 1.000)
Quadrant 2
-P
+Q
Inductive
Capacitive

## Examples of measuring ranges with Phase angle




## Examples of measuring ranges with cosφ



# 5. Installation

Transducer can be mounted either on a top-hat rail or directly on to a wall by a mounting plate.




As the front of the enclosure conforms to IP 40. The terminals of the product should be protected from liquids.

The Transducer should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range 0 to 45 $^{0}$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

1. **In the interest of safety and functionality this product must be installed by a qualified engineer, abiding by any local regulations.**
2. **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.**
3. **These products do not have internal fuses therefore external fuses must be used to ensure safety under fault conditions.**

## 5.1: 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.

1. 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.

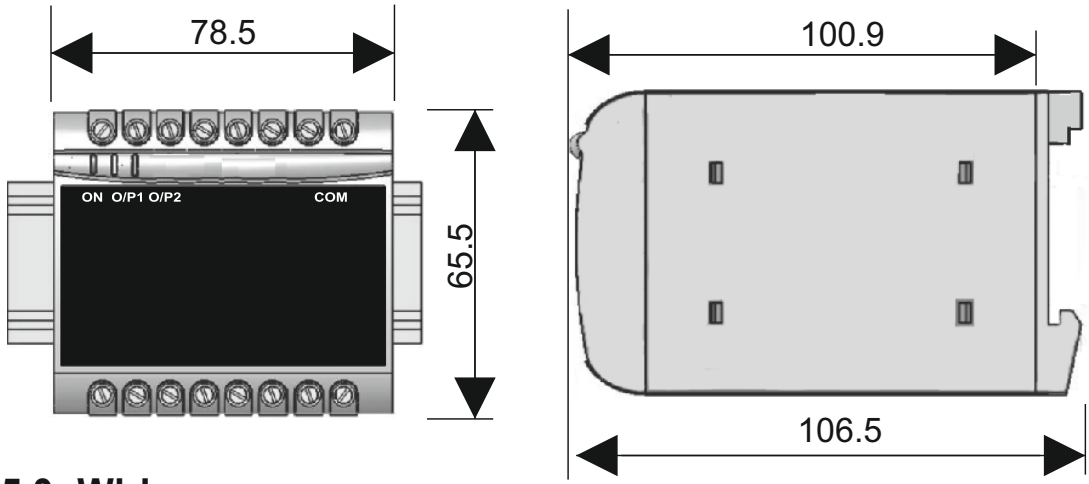
**Note:** It is good practice to install sensitive electronic instruments that are performing critical functions, in EMC enclosures that protect against electrical interference which could cause a disturbance in function.

2. Avoid routing leads alongside cables and products that are, or could be, a source of interference.

3. 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.

4. ESD precautions must be taken at all times when handling this product.

## 5.2: Case Dimension




## 5.3: Wiring

Input connections are made directly to screw-type terminals with indirect wire pressure. Choice of cable should meet local regulations. Terminal for both Current and Voltage inputs will accept up to 4.0 mm single wire or 2 x 2.5 mm fine wire.

## 5.4: Auxiliary Supply

Transducer 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. A switch or circuit,may be used in close proximity to the equipment & within easy reach of the OPERATOR & It shall be marked as the disconnecting device for the equipment.

## 5.5: Fusing

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

## 5.6: Earth/Ground Connections

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

## 5.7: Maintenance

No maintenance is required.

## 6. Specifications :

| | |
|---|---|
| **Measured Parameter** | Active Power / Reactive Power / Apparent Power / Power Factor /Phase Angle. |
| **Network Type Supported for Power :** | Single Phase /<br>3 phase 3 wire Unbalanced load/<br>3 phase 4 wire Unbalanced load/<br>3 phase 3 wire balanced load/<br>3 phase 4 wire balanced load. |
| **Network Type Supported for Power Factor & Phase Angle :** | Single Phase /<br>(U12 I1) 3 Phase Balanced load /<br>(U31 I1) 3 Phase Balanced lado/<br>(U23 I1) 3 Phase Balanced load /<br>3 phase 3 wire balanced load/<br>3 phase 4 wire balanced load. |

**Nominal Voltage Input($U_N$):**

| | |
|---|---|
| Nominal input Voltage (AC RMS) (PT Secondary range) | $100\ V \leq U_N \leq 500\ V_{L-L}$ |
| PT Primary range | 100V to 692.8 $KV_{L-L}$ |
| Nominal Frequency $F_N$ | 45 to 66 Hz |
| Nominal input Voltage burden | < 0.6 VA per phase at $U_N$ |
| Overload Capacity: | 1.2 * $U_N$ continuously,<br>2 * $U_N$ for 1 second, repeated 10 times at 10 minute intervals<br>But maximum $300V_{L-N}$ with Aux supply powered from measuring input. |

**Nominal Current Input($I_N$):**

| | |
|---|---|
| Nominal input current (AC RMS) (CT Secondary range) | 1 A ≤ $I_N$ ≤ 5 A |
| CT Primary range | 1 A to 9999 A |
| Nominal Frequency $F_N$ | 45 to 66 Hz |
| Nominal input Current burden | < 0.2 VA per phase at $I_N$ |
| Overload Capacity | 1.2 * $I_N$ continuously,<br>10 * $I_N$ for 3 second, repeated 5 times at 5 minute intervals.<br>50 * $I_N$ for 1 second, repeated 1 times at 1 hour interval(But max 250 A). |

**Allowed measuring range end values X2 (calibration factor Xc):**

With single phase AC Active / Reactive / Apparent Power

[0.3 ≤ (X2 / Rated Power) ≤ 1.3 ]• ($U_N$ • $I_N$ /3)

With 3-phase AC Active / Reactive / Apparent Power

[0.3 ≤ (X2 / Rated Power) ≤ 1.3 ]• (3 • $U_N$ • $I_N$)

(For single phase Rated Power = $U_N$ • $I_N$ /3 )

(For Three phase Rated Power = 3 • $U_N$ • $I_N$)

**Phase Angle & Power Factor measuring Range:**

Minimum span 20° to Maximum Span 350°

## Auxiliary: →◯

| | |
|---|---|
| AC/DC Auxiliary Supply | 60V…….300 VAC-DC ± 5%<br>24V…….60 VAC-DC ± 10% |
| Auxiliary Supply frequency range | 40 to 65 Hz |

Auxiliary Supply consumption

| | |
|---|---|
| 60V…….300 VAC-DC | ≤ 8VA for one output |
| | ≤ 10VA for two outputs |
| 24V…….60 VAC-DC | ≤ 5VA for one output |
| | ≤ 6VA for two outputs |

**Measuring Output Y( Single or Optional Dual):**

| | |
|---|---|
| Output type Y2 | Load independent DC Voltage , DC Current (On site selectable through DIP switches.) |
| Load independent DC output | Unipolar 0…20mA / 4…20mA OR 0…10V. Bipolar -20mA....0....+20mA OR -10V....0....+10V |
| Output burden with DC current output Signal | 0 ≤ R ≤ 15V/Y2 |
| Output burden with DC voltage output Signal | Y2/(2 mA) ≤ R ≤ 。 |
| Current limit under overload R=0 | ≤ 1.25 * Y2 with current output<br>≤ 100 mA with voltage output |
| Voltage limit under R= | < 1.25 * Y2 with voltage output<br>≤ 30 V with current output |
| Residual Ripple in Output signal | ≤ 1% pk-pk |
| Response Time | ≤750 ms |

**Accuracy :( Acc. to IEC 60688)**

| Reference Value | Output end Value Y2 (Voltage or Current) |
|---|---|
| Basic Accuracy for power transducer | 0.2*C |
| Basic Accuracy for Phase Angle & Power Factor transducer | 0.5*C |
| Factor C (the highest value applies) | |

**Linear characteristics:**

$$C = \frac{1 - \frac{Y0}{Y2}}{1 - \frac{X0}{X2}} \quad \text{or } C=1$$

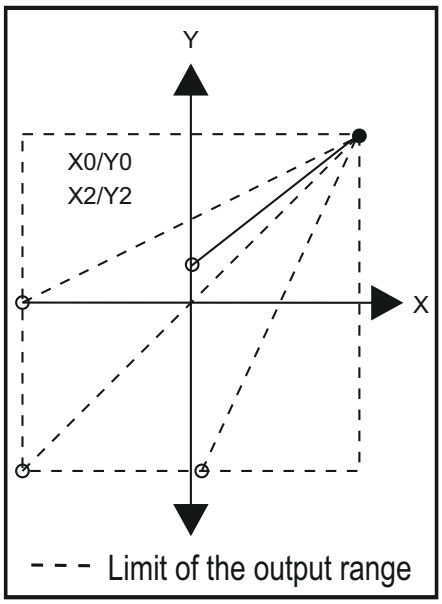
**Bent characteristics:**

$$\text{For } X0 \le X \le X1 \quad C = \frac{Y1 - Y0}{X1 - X0} \bullet \frac{X2}{Y2} \quad \text{or } C=1$$

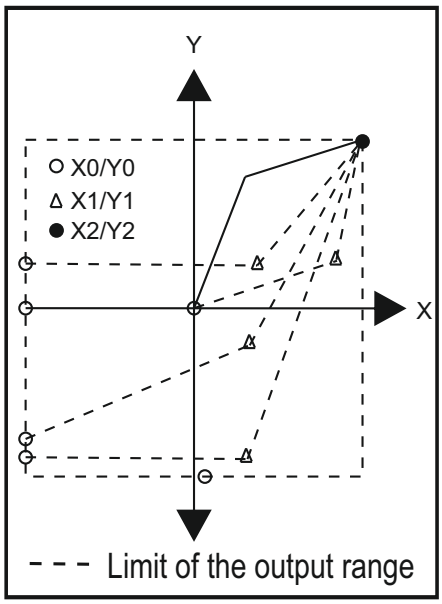
$$\text{For } X1 \le X \le X2 \quad C = \frac{1 - \frac{Y1}{Y2}}{1 - \frac{X1}{X2}} \quad \text{or } C=1$$

## Output characteristics:

1) Example of setting with Linear characteristics:




2) Example of setting with Bent characteristics:



X0 = Start value of input Y0 = Start value of output

X1 = Elbow value of input Y1 = Elbow value of output

X2 = End value of input Y2 = End value of output

$R_N$ = Rated value of output burden $U_N/I_N$ = Nominal input voltage/current

**Reference conditions for Accuracy :**

For Power Transducer:

| | |
|---|---|
| Ambient temperature | 23°C +/- 1°C |
| Pre-conditioning | 30 min acc. to IEC EN - 60688 |
| Input Variable | Rated Voltage / Rated Current Range |
| Input waveform | Sinusoidal, Form Factor 1.1107 |
| Input signal frequency | 50 or 60Hz |
| Active / Reactive / PF | Cos Φ=1 resp. Sin Φ = 1 |

For Phase Angle & Power Factor Transducer:

| | |
|---|---|
| Reference Value | For Phase angle = 90° resp.<br>For power factor = 0.5 |
| Auxiliary supply voltage | Rated Value |
| Auxiliary supply frequency | Rated Value |
| Output Load | Rn = 7.5 V / Y2 ± 1% With DC current output signal<br>Rn = Y2 / 1 mA ± 1% With DC voltage output signal |
| Miscellaneous | Acc. to IEC - 60688 |

**Additional Error:**

| | |
|---|---|
| Temperature influence | ± 0.2%/10°C |

**Influence of Variations:**

As per IEC EN-60688 standard.

| | |
|---|---|
| Output stability | <30min |

**Safety:**

| | |
|---|---|
| Protection | IP 40, housing acording to EN 60 529<br>IP 20,terminal according to EN 60 529 |
| Pollution degree | 2 |
| Installation Category | III |
| Insulation Voltage | 1min. ( EN 61 010-1)<br>7700V DC, Input versus outer surface<br>5200V DC,Input versus all other circuits<br>5200V DC, Auxiliary supply versus outer surface and output<br>690V DC, Output versus output versus each other versus outer surface. |

**Installation Data:**

| | |
|---|---|
| Mechanical Housing | Lexan 940 (polycarbonate)<br>Flammability Class V-0 acc. To UL 94, self extinguishing, non dripping, free of halogen |
| Mounting position | Rail mounting / wall mounting |
| Weight | Approx. 0.4kg |

**Connection Terminal:**

| | |
|---|---|
| Connection Element | Conventional Screw type terminal with indirect wire pressure |
| Permissible cross section of the connection lead | $\leq$ 4.0 $mm^2$ single wire or 2 x 2.5 $mm^2$ Fine wire |

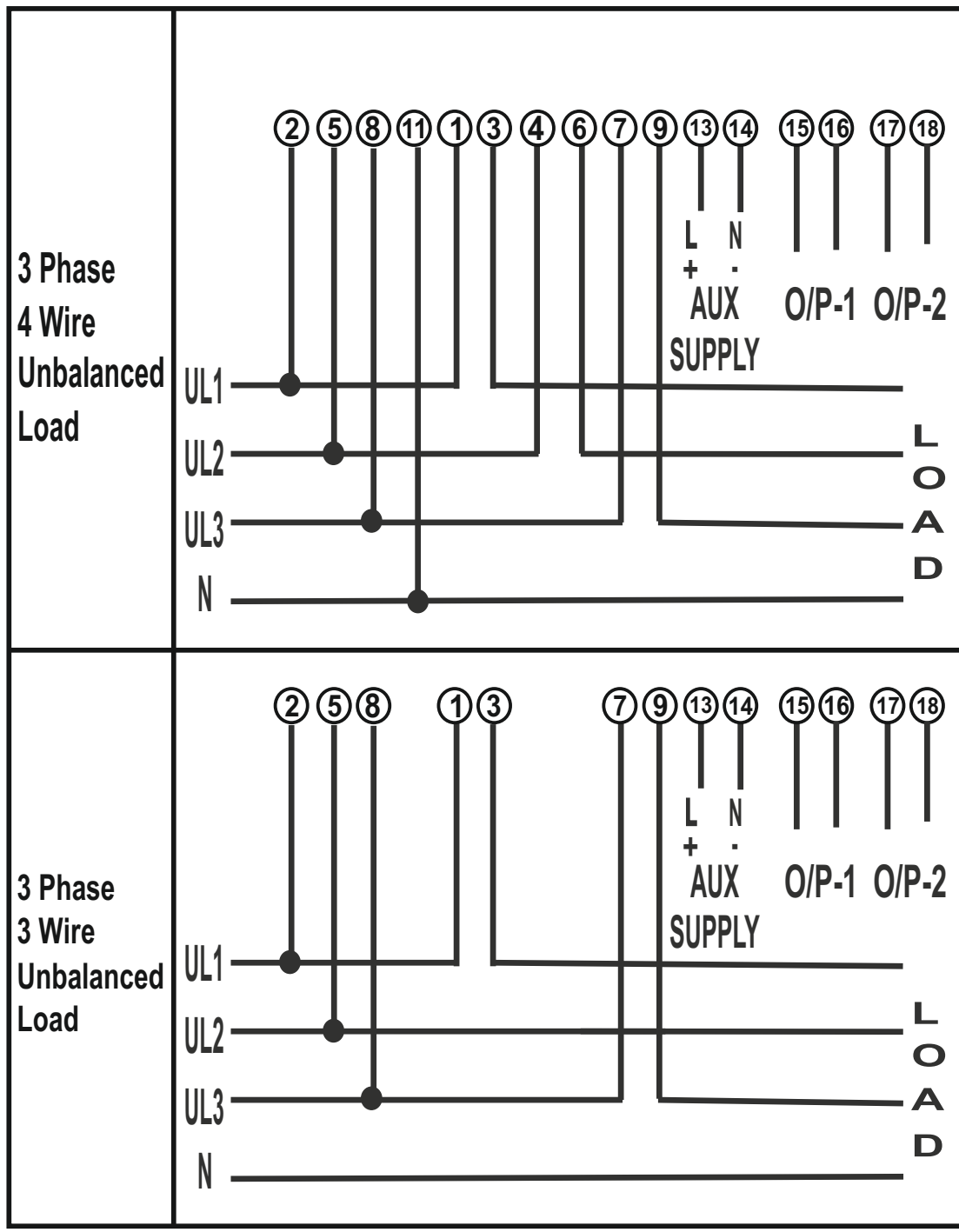
**Environmental:**

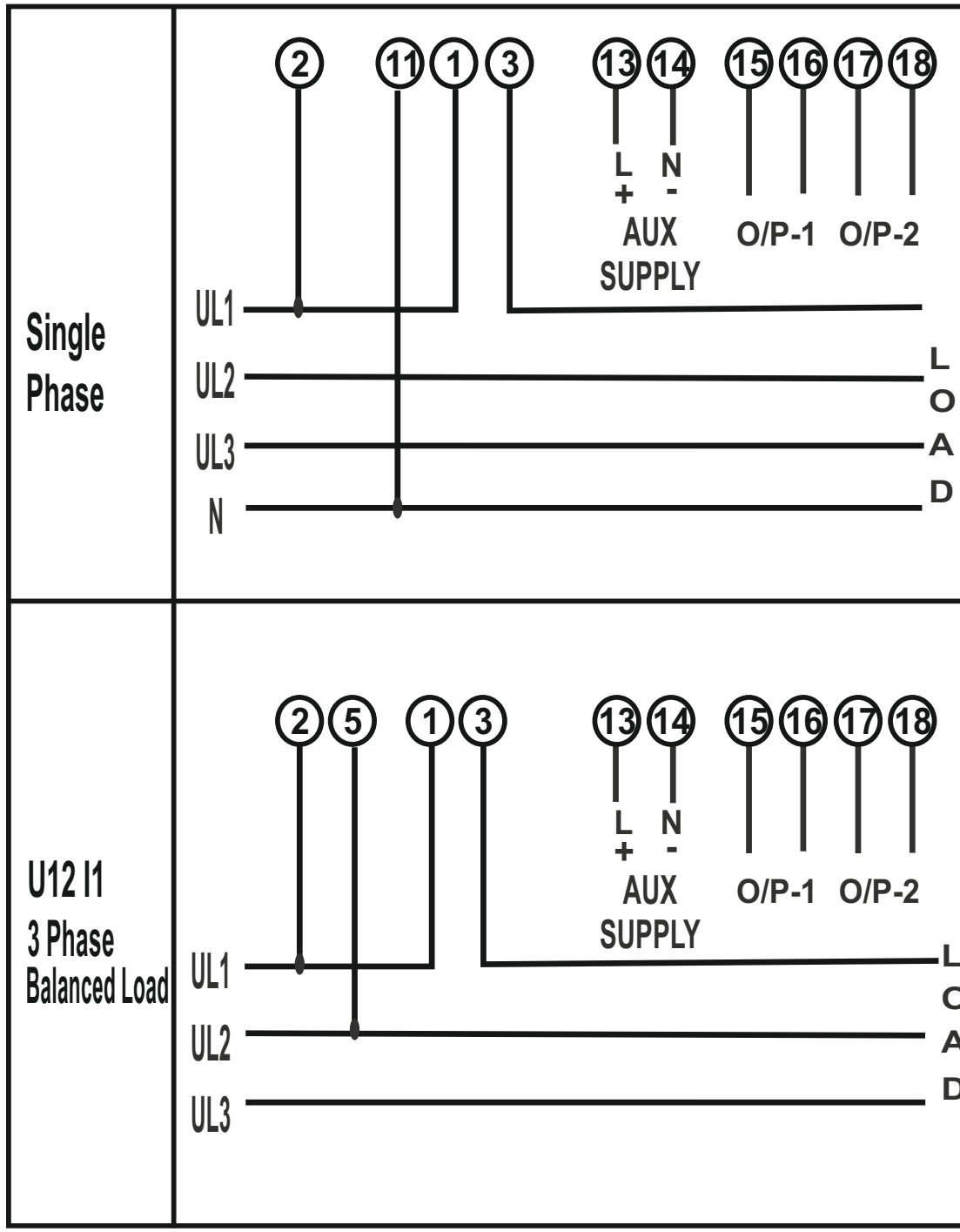
| | |
|---|---|
| Nominal range of use | 0 °C...23 °C... 45 °C(usage Group II) |
| Storage temperature | -40 °C to 70 °C |
| Relative humidity of annual | |
| Mean | $\leq$ 75% |
| Altitude | 2000m max |
| Location | Indoor use |

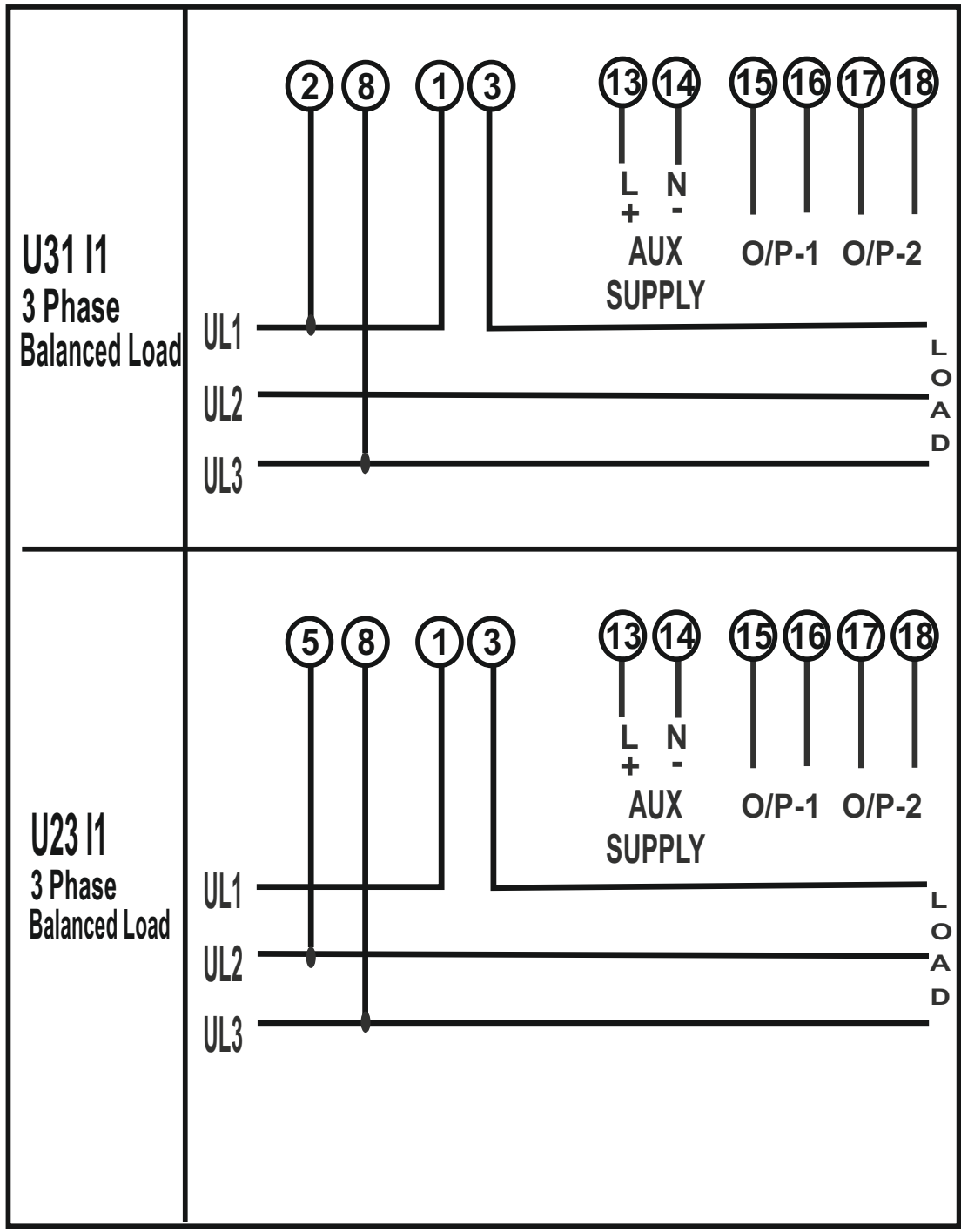
**Ambient tests:**

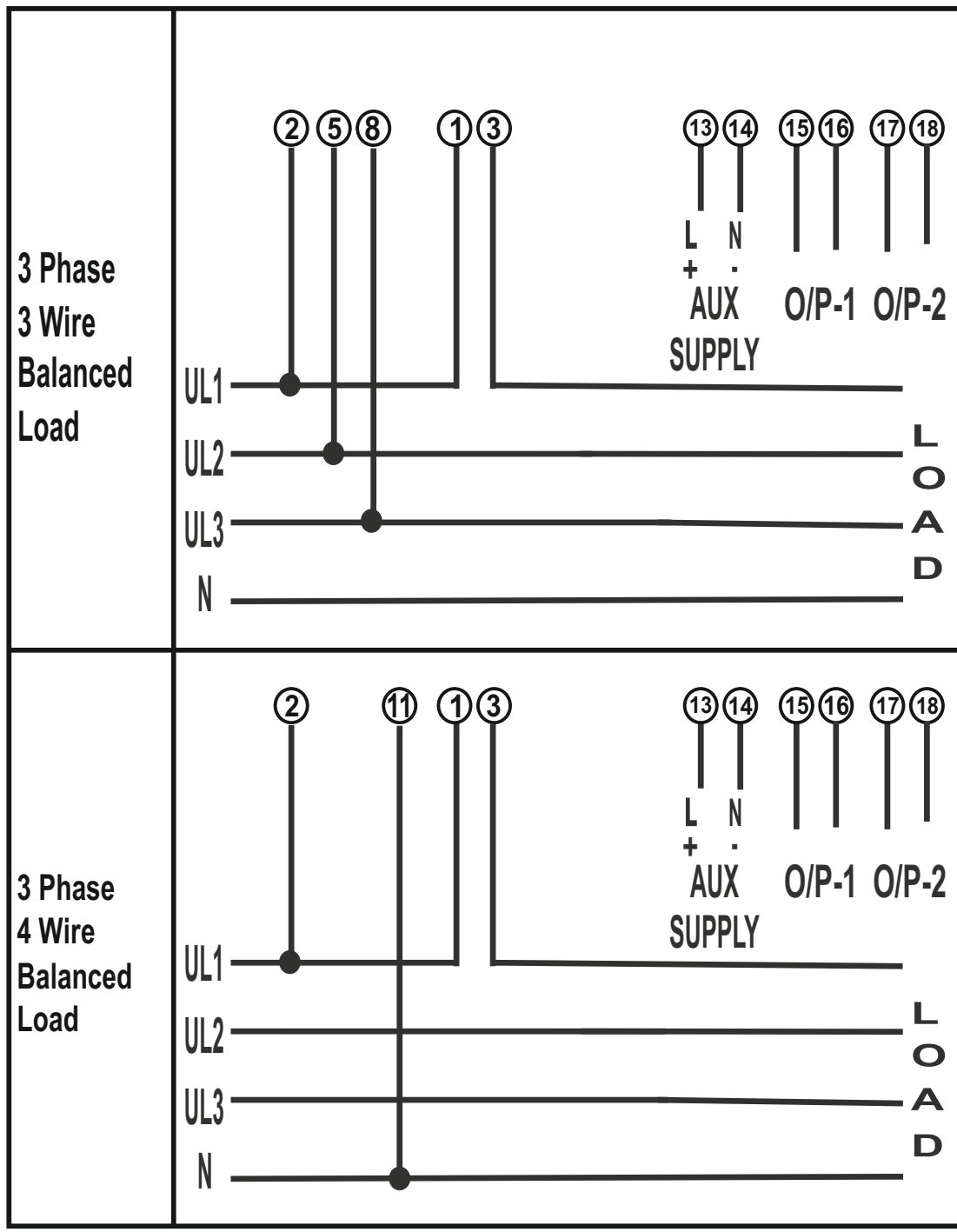
| | |
|---|---|
| IEC 60 068-2-6 | Vibration |
| Acceleration | ± 2 g |
| Frequency range | 10....150...10Hz, |
| Rate of frequency sweep | 1 octave/minute |
| Number of cycles | 10, in each of the three axes |
| EN 60 068-2-7 | Shock |
| Acceleration | 3 x 50g |
| | 3 shocks in each direction |
| EN 60 068-2-1/-2/-3 | Cold, Dry, Damp heat |
| IEC 61000-4-2/-3/-4/-5/-6 | |
| IEC 61326 | Electromagnetic compatibility. |

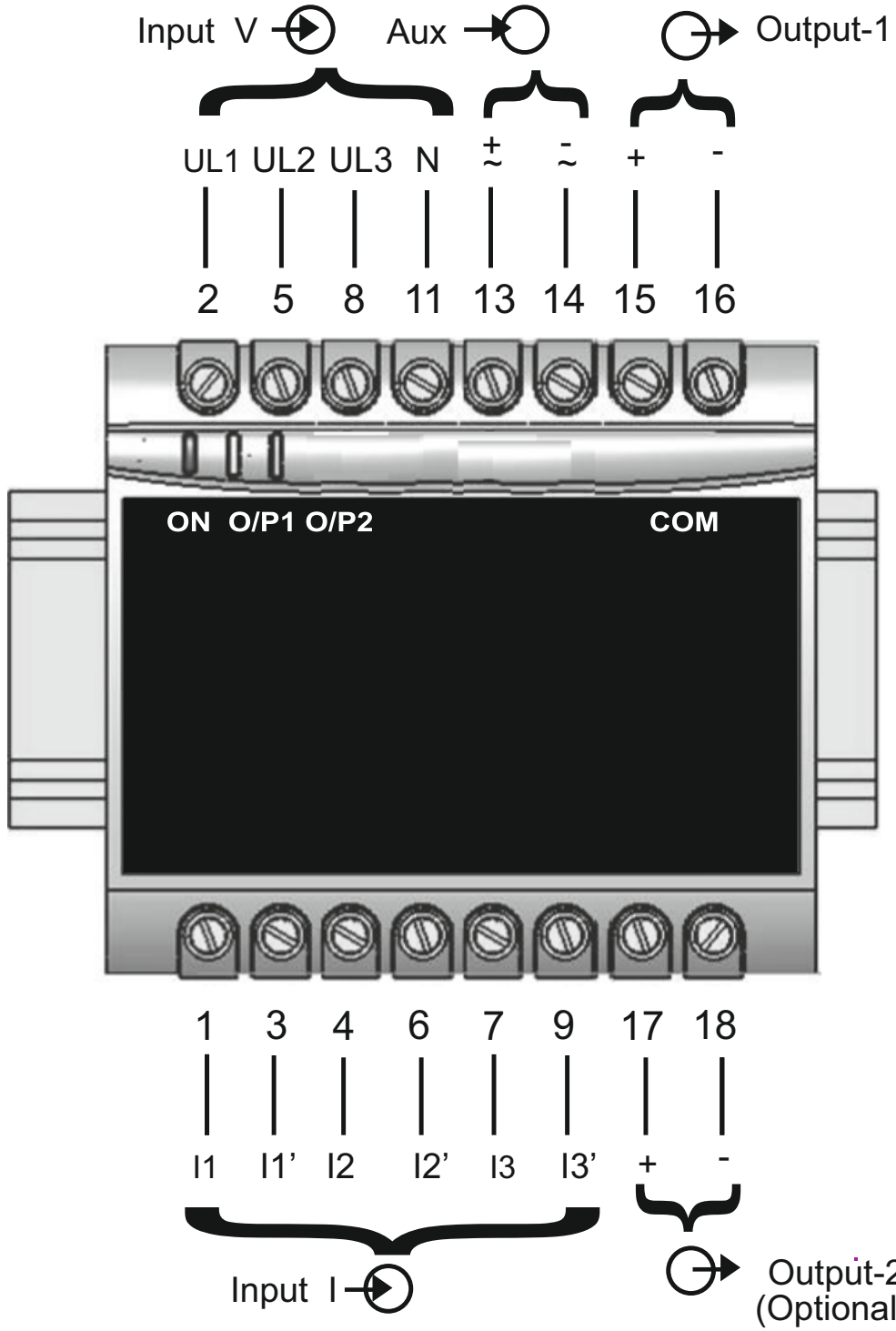
# 7. Connection Diagram




Single
Phase
2
11
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
N
LOAD
U12 I1
3 Phase
Balanced Load
2
5
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
LOAD


U31 I1
3 Phase
Balanced Load
2
8
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
LOAD
U23 I1
3 Phase
Balanced Load
5
8
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
LOAD


3 Phase
3 Wire
Balanced
Load
2
5
8
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
N
LOAD
3 Phase
4 Wire
Balanced
Load
2
11
1
3
13
14
15
16
17
18
L
+
N
-
AUX
SUPPLY
O/P-1
O/P-2
UL1
UL2
UL3
N
LOAD


Input V
Aux
Output-1
UL1 UL2 UL3 N
±
~
-
~
+
-
2 5 8 11 13 14 15 16
ON O/P1 O/P2
COM
1 3 4 6 7 9 17 18
I1 I1' I2 I2' I3 I3'
+
-
Input I
Output-2
(Optional)

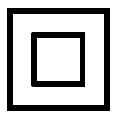
## RS-485 Connection

| RS-485 | | |
|---|---|---|
| B | A | G |

## Meaning of symbols on the instrument



Warning concerning a point of danger
(Attention:observe documentation)



Equipment protected throught by
Double insulation or reinforced
insulation



DC voltage /Current



AC/DC voltage




Isolation between input versus all
other circuit is 3.7 KV.

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. It is the user's responsibility to determine the suitability of the installation method in the user's field conditions.

## NOTE

## NOTE

# NOTE