Operating Manual

Programmable V/I/Hz Transducer

RISH *CON* - V/I/Hz

IC: 15000855

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V/I/Hz Transducer

Programmable AC Voltage/Current/Frequency Transducer

Installation & Operating Instructions
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1. Introduction

The V/I/Hz Transducer is a DIN Rail / Wall mounted 43.8X 65.5mm Transducer.
The V/I/Hz Transducer is used to measure and convert AC Voltage / Current / Frequency input into an proportional DC current or voltage output signal.
Output signal generated is proportional to the True RMS(upto 15th Harmonic) of the input Voltage/Current/Frequency.

1.1 LED Indication

LED	LED Operating Conditions	LED Operating Status
ON	Aux. supply healthy condition	Green LED continuous ON
O/P1	Output 1 voltage	Green LED continuous ON
	Output 1 Current	Red LED continuous ON
O/P2	Output 2 voltage	Green LED continuous ON
	Output 2 Current	Red LED continuous ON

Table 1: Measured parameters

Measured parameters	Unit of Measurement
Voltage	V
Current	A
Frequency	Hz

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. .

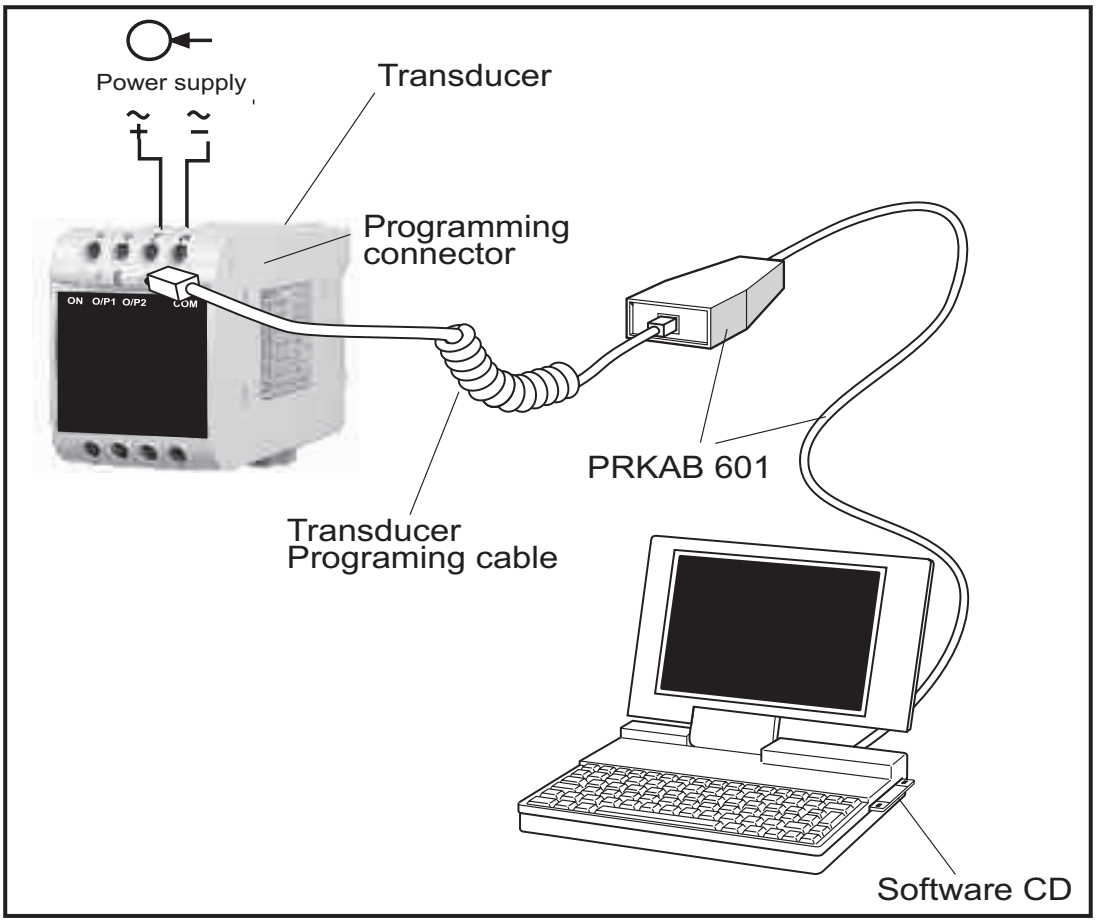
For programming of Transducer, steps to be followed are

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.



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.

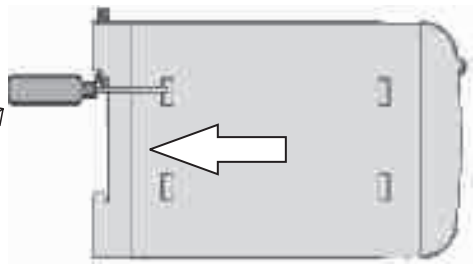
Note: If DIP switch setting is done first and then output type parameter is configured using either of the above three methods then switch OFF-ON the Transducer.

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 transduceer by using screw driver.

Insert screw driver in a snap fitting slot and press in direction of arrow, remove all snap fitting pillars of back cover.



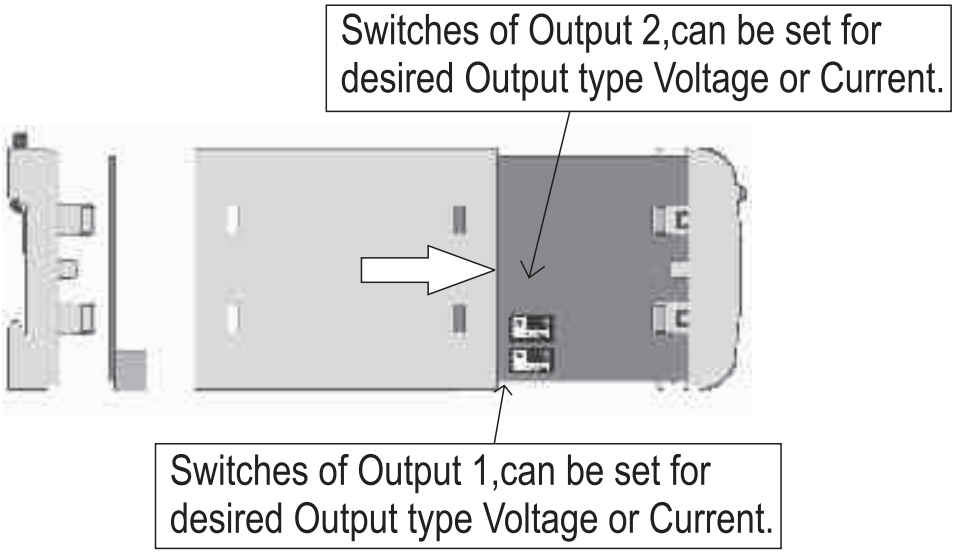
3) Remove the front cover and take the Output card out.

Insert screw driver in a snap fitting slot and press in direction of arrow, remove all snap fitting pillars of front cover.

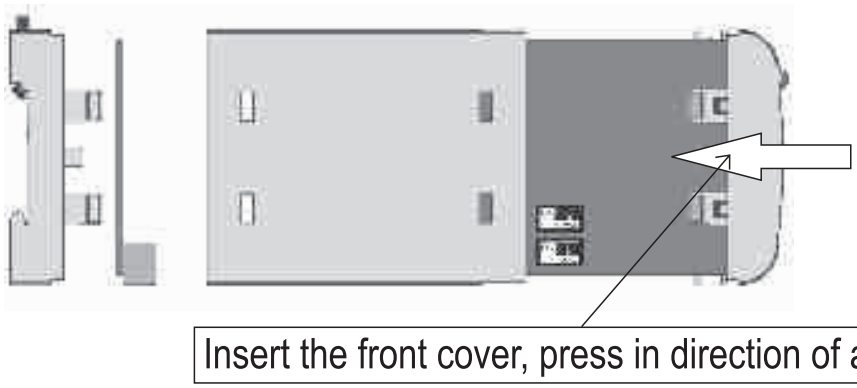
4) Configure the switches for Voltage or Current as shown below.

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

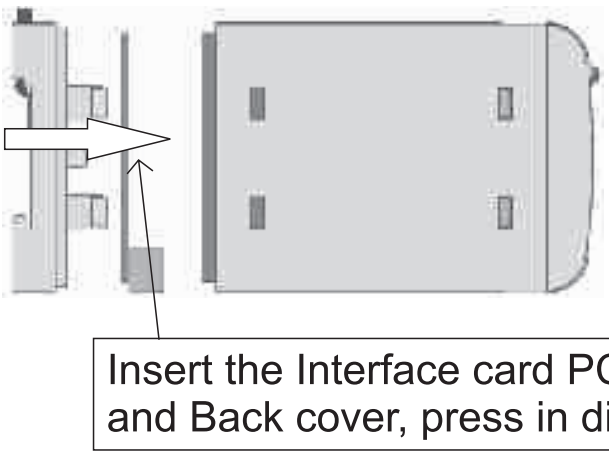
Note: Black portion in this diagram indicates switch position



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



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



7) After inserting the back cover transducer, can be used for required application.

3. RS 485 (ModBus)

V/I/Hz 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 V/I/Hz Transducer is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time of an V/I/Hz 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 V/I/Hz 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 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.

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 V/I/Hz 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 V/I/Hz 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 ,
Current : Start address= 06 (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)	06 (Hex)	00 (Hex)	02 (Hex)	91 (Hex)	CA (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: Current (5.0A)

01(Hex)	04 (Hex)	04 (Hex)	40 (Hex)	A0 (Hex)	00 (Hex)	00 (Hex)	EE (Hex)	66 (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 parameterrequested.

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
30001	1	Voltage	00	00
30007	2	Current	00	06
30071	3	Frequency	00	46

Note: Parameter no. 1 is applicable to Voltage Transducer.
Parameter no. 2 is applicable to Current Transducer.
Parameter no. 3 is applicable to Frequency Transducer.

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.)

Example : Writing Device address

Device address : Start address= 0E (Hex) Number of registers = 02

Query:(Change Device address to 2)

Device Address	01 (Hex)
Function Code	03 (Hex)
Starting Address Hi	00 (Hex)
Starting Address Lo	0E (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	40 (Hex)
Data Register-1 Low Byte	00(Hex)
Data Register-2 High Byte	00(Hex)
Data Register-2 Low Byte	00(Hex)
CRC Low	67 (Hex)
CRC High	E3 (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.)

Response:

Device Address	01 (Hex)
Function Code	10 (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	20 (Hex)
CRC High	0B (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.)

Table 3 : 4 X register addresses

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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	-	-	-	-
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	-	-	-	-
40027	14	Sim_ Output A	Wp	00	1A
40029	15	Sim_ Output B	Wp	00 00	1C
40031	16	Analog O/P Type 1	R/Wp	00	1E
40033	17	-	-	-	-
40035	18	Analog O/P Type 2	R/Wp	00	22
40037	19	-	-	-	-
40039	20	-	-	-	-

Note: Parameter no. 6 & 7 are not applicable to Voltage Transducer.
Parameter no. 4 & 5 are not applicable to Current Transducer.
Parameter no. 4 to 7 are not applicable to Frequency Transducer.

Explanation for 4 X register :

Address	Parameter	Description
–	–	–
40003	Mode Selection	This is used to select the Mode of operation. Normal mode = 1. Simulation mode = 2.
–	–	–
40009	PT Pimary	This address allows the user to read and write PT Primary value. The PT Primary value is in between 57V to 400kV.
40011	PT Secondary	This address is used to read and write the PT secondary value in range between 57V to 500V.
40011	CT Pimary	This address allows the user to read and write CT Primary value. The maximum settable value is 9999.
40013	CT Secondary	This address is used to read and write the CT secondary value in range between 1A to 5A.
40015	Device Adress	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.
–	–	–
–	–	–

40027	Sim_ Output A	This address is used to set the simulation Output A to 10% of Output by writing 1000 and 100% of Output by writing 10000
40029	Sim_ Output B	This address is used to set the simulation Output B to 10% of Output by writing 1000 and 100% of Output by writing 10000
40031	Analog O/P Type 1	This address is used to set the Analog O/P Type 1 as Voltage/Current. Voltage = 1. Current = 2.
–	–	–
40035	Analog O/P Type 2	This address is used to set the Analog O/P Type 2 as Voltage/Current. Voltage = 1. Current = 2.

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
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. Installation

The V/I/Hz Transducer can be mounted either on a top-hat rail or directly on to a wall or a mounting plate.

As the front of the enclosure conforms to IP40.The terminals of the product should be protected from liquids

The V/I/Hz 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 arede-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.**

4.1 EMC Installation Requirements

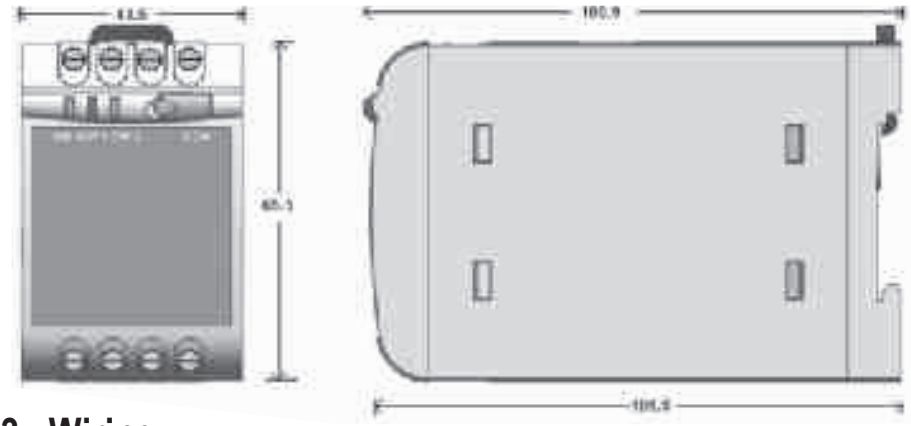
This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

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.

4.2 Case Dimension



4.3 Wiring

Input connections are made directly to screw-type terminals with indirect wire pressure. Choice of cable should meet local regulations. Terminal for Current inputs will accept up to 2x 2.5mm² or ≤ 4.0 mm^2 cables.

4.4 Auxiliary Supply

V/I/Hz 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.

4.5 Fusing

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

4.6 Earth/Ground Connections

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

5. Specification

Input:

Voltage Transducer

Nominal input Voltage U_N (AC RMS)	57 V ≤U_N≤ 500 V
(PT Secondary range)	
PT Primary range	57 V to 400 kV
Nominal Frequency F_N	45....66 Hz
Nominal input Voltage burden	< 0.6 VA at U_N

Overload Capacity:	1.2 * U_N continuously, 2 * U_N for 1 second, repeated 10 times at 10 minute intervals But maximum 300V with power supply powered from measuring input.

Current Transducer

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...66 Hz
Input burden	< 0.2 VA at I_N
Overload Capacity:	1.2 * I_N continuously, 10 * I_N for 3 second, repeated 5 times at 5 minute intervals. 50 * I_N for 1 second, repeated 1 times at 1 hour intervals. (max 250 A).

Frequency Transducer

Measuring Ranges	45Hz to 55Hz, 48Hz to 52Hz, 55Hz to 65Hz, 45Hz to 65Hz (min span 4Hz)
Nominal input Voltage(U_N)	57V ≤ U_N ≤ 500 V
Nominal input Voltage burden	< 0.6 VA max
Overload Capacity:	1.2 *U_N continuously, 2 *U_N for 1 second, repeated 10 times at 10 minute intervals

Auxiliary:

AC/DC Auxiliary Supply	60V…….300 VAC-DC ± 5% 24V…….60 VAC-DC ± 10%
Aux.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	Load independent DC Voltage or DC Current (Onsite selectable through DIP switches & Programming.)
Load independent DC output	0…20mA / 4…20mA OR 0…10V.
Output burden with DC current output Signal	$0 \leq R \leq 15V/Y2$
Output burden with DC voltage output Signal	$Y2/(2\ mA) \leq R \leq \infty$
Current limit under overload R=0	$\leq 1.25 * Y2$ with current output $\leq \leq 100$ mA with voltage output
Voltage limit under R=∞	< 1.25 * Y2 with voltage output ≤ 30 V with current output
Residual Ripple in Output signal	≤ 1% pk-pk
Response Time	<400 ms.

Accuracy:(Acc. to IEC 60688)

Reference Value	Output end Value Y2 (Voltage or Current)
Basic Accuracy	0.2*C
Factor C (The Highest value applies)	

Linear characteristics:

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

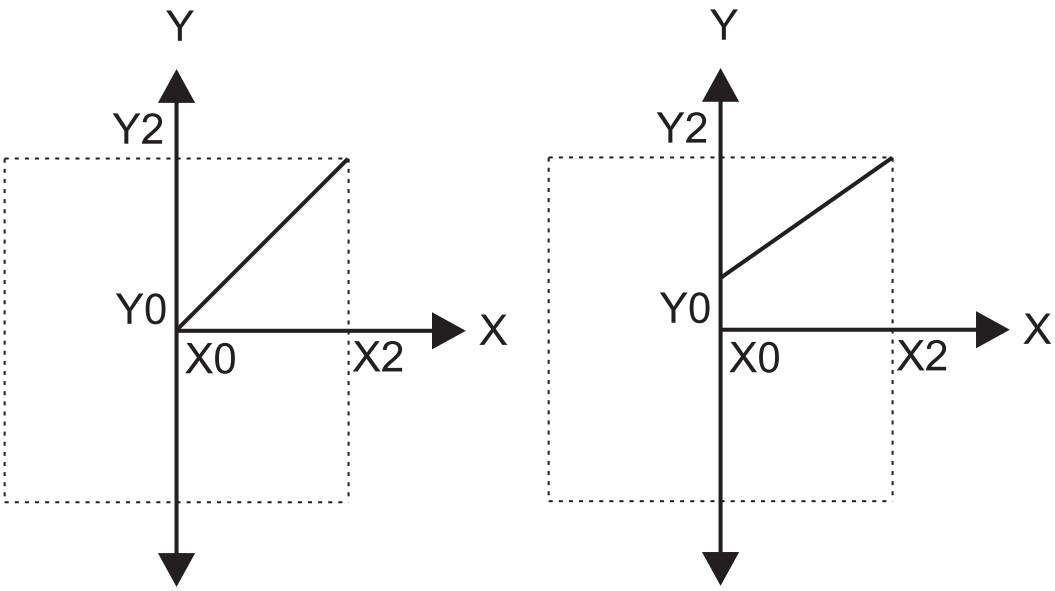
Bent characteristics:

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

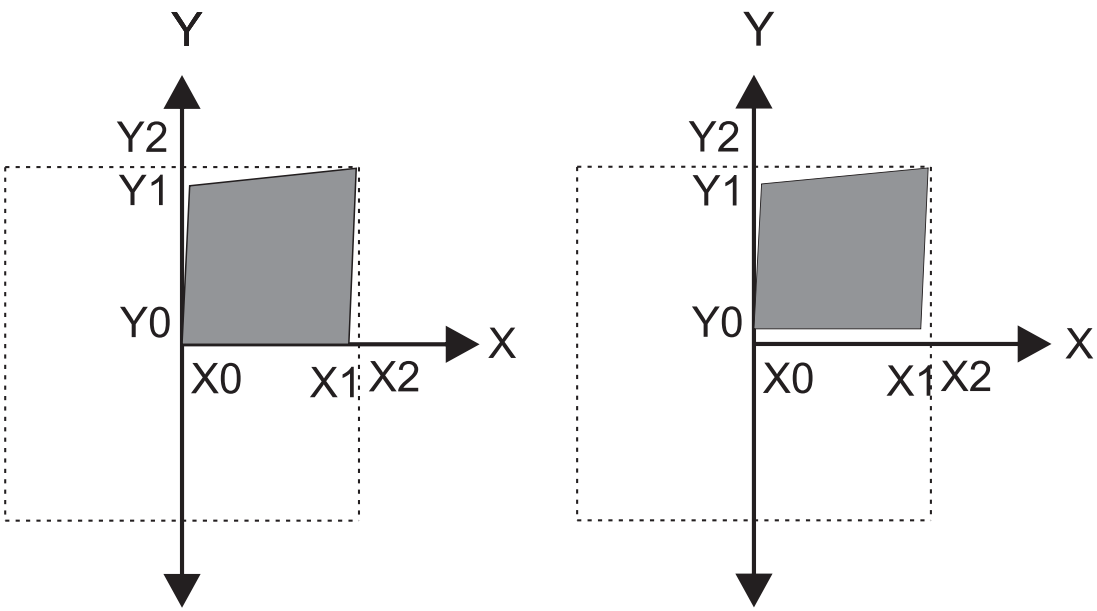
For $X1 \leq X \leq X2$ $C = \frac{1 - \frac{Y1}{Y2}}{1 - \frac{X1}{X2}}$ or C=1

Output characteristics:

1) Example of setting with Linear characteristics:



2) Example of setting with Bent characteristics:



X0 = Start value of input
X1 = Elbow value of input
X2 = End value of input
R_N = Rated value of output burden

Y0 = Start value of output
Y1 = Elbow value of output
Y2 = End value of output
U_N/I_N = Nominal input voltage/ current

Reference conditions for Accuracy :

Ambient temperature	23°C +/- 1°C
Pre-conditioning	30 min acc. to IEC EN - 60688
Input Variable	Rated Voltage / Rated Current
Input waveform	Sinusoidal, Form Factor 1.1107
Input signal frequency	50 or 60Hz
Auxiliary supply voltage	Rated Value
Auxiliary supply frequency	Rated Value
Output Load	R_N = 7.5 V / Y2 ± 1%With DC current output signal. R_N = 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 Class	II (Protection Isolated, EN 61010)
Protection	IP 40, housing acording to EN 60 529 IP 20,terminal according to EN 60 529
Pollution degree	2
Installation Category	III
Insulation Voltage	1min. (EN 61 010-1) 7700V DC, Input versus outer surface 5200V DC, Input versus all other circuits 5200V DC, Auxiliary supply versus other surface and output 690V DC, Output versus output versus each other versus outer

Installation Data:

Mechanical Housing	Lexan 940 (polycarbonate) 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:

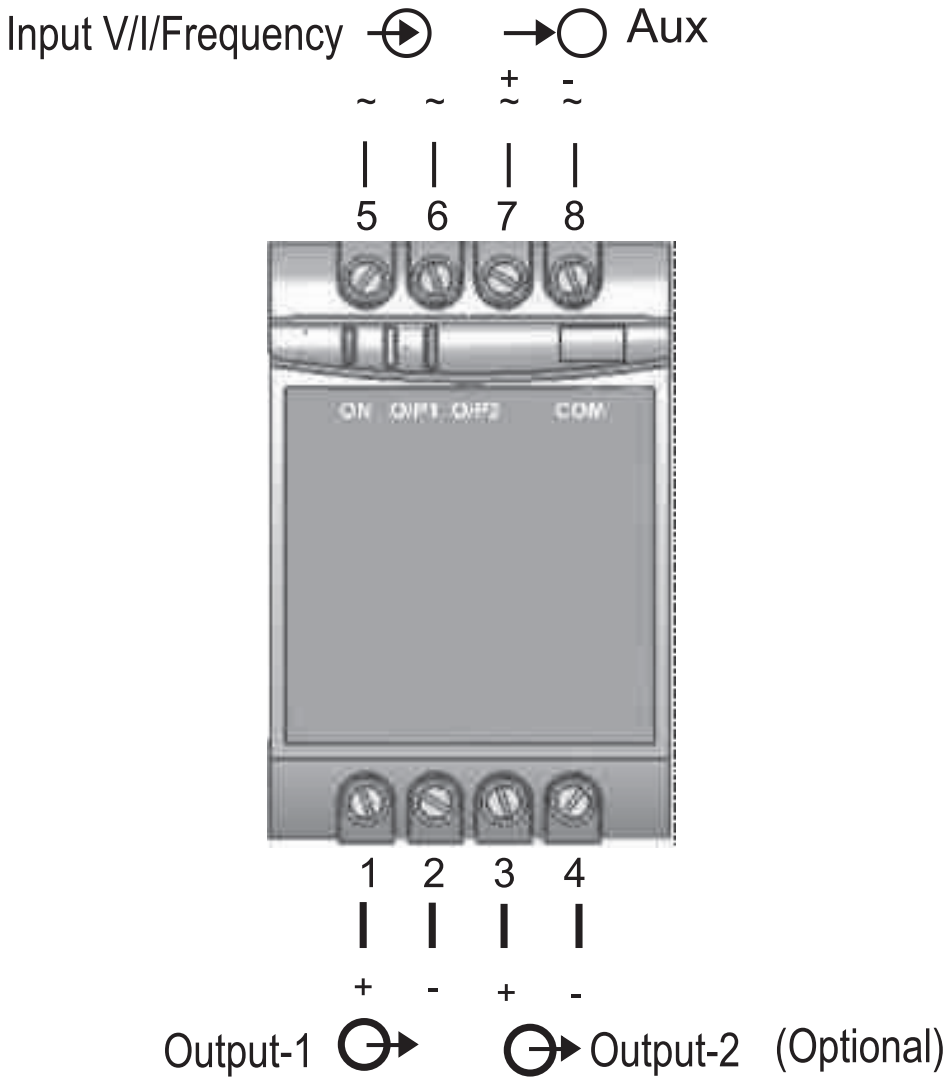
Nominal range of use	0 °C...23 °C... 45 °C(usage GroupII)
Storage temperature	-40 °C to 70 °C
Relative humidity of annual mean	$\leq$ 75%
Altitude	2000m max

Ambient tests:

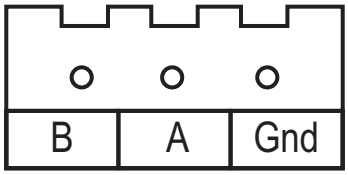
IEC 60 068-2-6	Vibration
Acceleration	± 2g
Frequency range	10....150...10Hz,
Rate of frequency sweep	1 octave/minute
Number of cycles	10, in each of the three axes
EN 60 068-2-7	Shock
Acceleration	3 x 50g 3 shocks in each direction
EN 60 068-2-1/-2/-3	Cold, Dry, Damp heat
IEC 61000-4-2/-3/-4/-5/-6 IEC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

6. Connection Diagram

Connection	Terminal details	
Measuring input	~ ~	5 6
Auxilliary Power supply	~ , + ~ , -	7 8
Measuring output - 1	+ -	1 2
Measuring output - 2	+ -	3 4



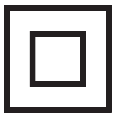
RS 485 Connections:



RS 485

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.

NOTE

NOTE

NOTE

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. However, Manufacturer has no control over the field conditions which influence product installation.

It is the user's responsibility to determine the suitability of the installation method in the user's field conditions. Manufacturer only obligations are those in Manufacturer standard Conditions of Sale for this product and in no case will Manufacturer be liable for any other incidental, indirect or consequential damages arising from the use or misuse of the products.

NOTE

NOTE

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