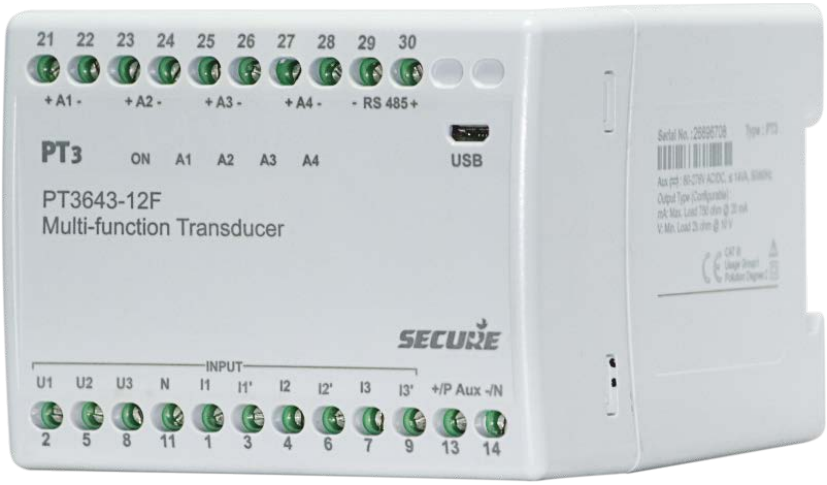
PT3 transducer range



Technical reference manual

BGX701-014-R03

Table of Contents

1 Preface

1.1 Purpose and audience

This manual provides the information necessary to configure, install, and use the PT3 range of transducers. The information in the manual is intended for use by technically qualified commissioning and operating personnel in power systems and process industries. Troubleshooting suggestions and answers to FAQs are included to assist in the installation and operation of the PT3 transducers.

1.2 Abbreviations

Following is a list of abbreviations used in this manual:

Abbreviation	Description
PT	Programmable transducers
FAQs	Frequently asked questions
RMS	Root mean square
HDD	Hard disk drive
CT	Current transformer
AC	Alternating current
DC	Direct current
USB	Universal serial bus
MFT	Multi-function transducer
PDU	Protocol data unit

1.3 Related documentation

The ConfigView software tool is used to set up all the configurable features in PT3 transducers. You can download the ConfigView software and associated documentation free of cost, from our website: www.securemeters.com.

Note:

We recommend use of the latest version of ConfigView software for programming PT3 transducers.

2 Disclaimer

Secure Meters assumes no responsibility for damages caused to the PT3 transducer unit under following circumstances:

1. Improper maintenance/installation
2. Normal (or abnormal) wear and tear of insulation
3. Accidental contact with hazardous elements

3 Important safety information

Local best practice and regulatory stipulations must always be observed. In addition, safety precautions recommended for installation of electrical equipment should be strictly adhered to. Transducers should be installed by trained personnel only.

The following symbols have been used in this document or appear on the product.

				
Risk of electric shock	**Caution**	**Alternating current (AC)**	**Direct current (DC)**	**Double Insulation**

3.1 Safety during installing/ uninstalling and servicing

1. Use insulated crimp terminations to make voltage and current connections. Ensure that the terminal block insulation requirements are always met.
2. Read the information provided on the rating plate carefully before making the connections or installing/uninstalling the transducers. The rating plate is available on the right-hand side of the device.
3. Use a switch or circuit breaker to disconnect the auxiliary supply to the transducers. Mark it suitably and keep it handy for quick access to ensure appropriate safety.
4. If the equipment is not used in the manner specified in the manual, the protection provided by the equipment may be impaired.

1. Do not touch any exposed terminals during installing/uninstalling or maintenance as hazardous voltages are present, which constitute a major risk of electrical shock and can cause severe and permanent injury.
2. Before switching on the transducer device, verify that all connections to the network have been correctly made.
3. Do not open the secondary circuit of a live CT as the high voltage produced could be lethal or cause severe injury.
4. Disconnect the power supply before installing the transducer within a panel. The same instructions should be followed for uninstalling the device.

3.2 Disposal

PT3 transducers should be disposed of in a safe and responsible manner. The regulations applicable within the country of operation for disposal of the product should be followed.

3.3 Maintenance

PT3 transducers normally require no maintenance. To ensure a robust user experience, please adhere to the environmental and technical specifications provided by the manufacturer. For any further queries, you may contact the nearest sales representative.

4 Introduction to three-phase transducers

The PT3 transducer is suitable for measuring, monitoring and analysing three-phase industrial and supply applications. It is available with up to four analogue outputs and can accurately measure electrical quantities such as current, voltage, active power, reactive power and power factor by converting them into proportional DC current or voltage analogue signals (For e.g. 0-10 V, 0-2mA, 4-20 mA etc.). The output signal that is generated is proportional to the true RMS value of the input signal.

Salient features

- Available in single-function and multi-function variants
- Available with high or low auxiliary power supply options
- Has two or four, galvanically isolated, load independent analogue outputs
- Has a loop impedance support of ≤750 Ω for current and ≥2 kΩ for voltage outputs (independent of analogue outputs used)
- Provides a full-scale accuracy class of 0.2, 0.5 or 1.0
- Offers a response time of < 220 ms
- Offers fast sampling rates and accurate RMS measurements over a long range
- Measures V, I, PF, active and reactive power, load PF, apparent power and frequency
- Can be configured onsite for required input measurement range, output type (either mA or V) and curves
- Multiple functions can be configured as input for multi-function transducers. Different input functions can be assigned for measurement to each of the four output channels or a single input function can be assigned to all channels.
- Easily configurable through micro USB port without the need for power supply
- LEDs for signalling Power ON and diagnostics
- Top hat DIN Rail mountable as per EN50022

4.1 Physical features

The figure below provides an illustrated reference to the main parts of the PT3 transducer device.

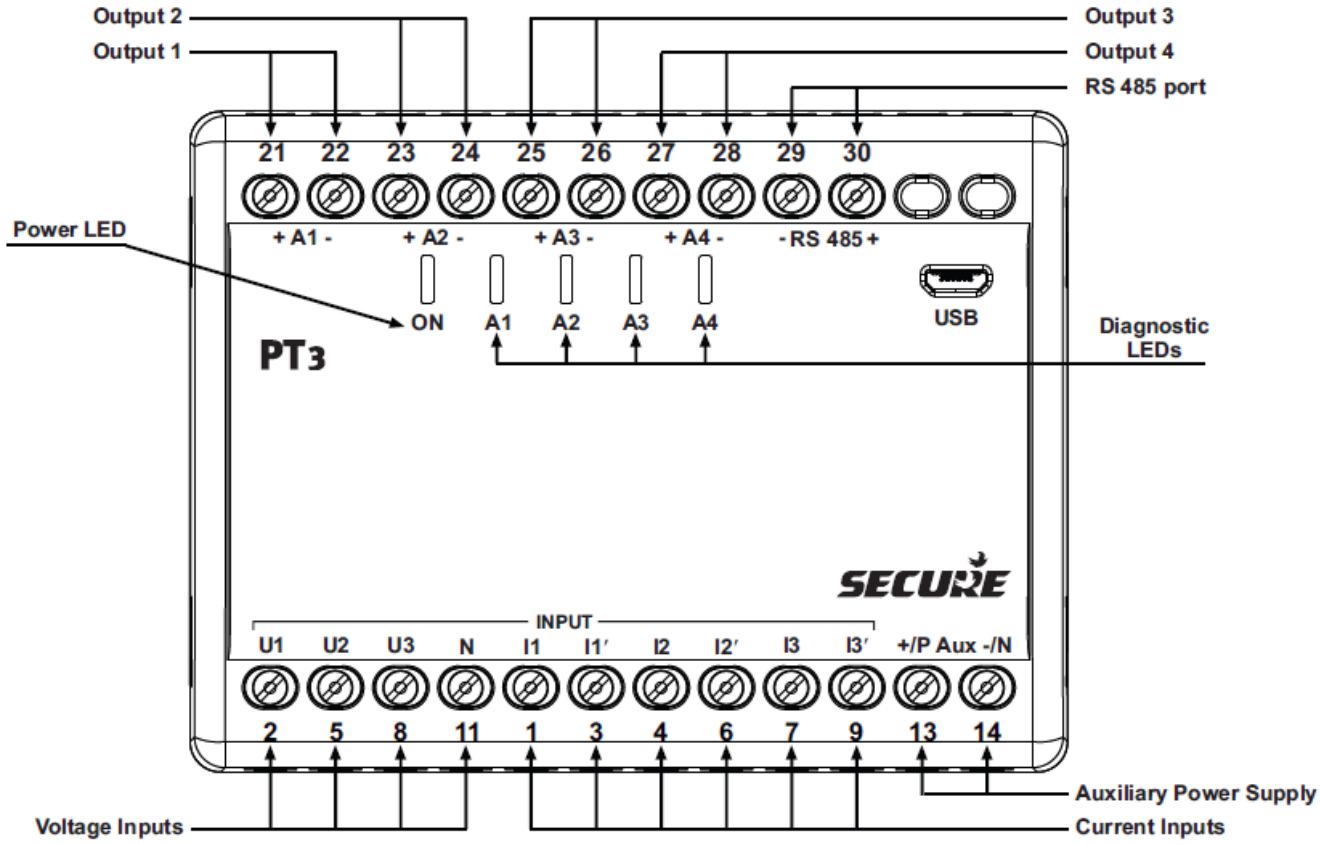


Figure 1: PT3 transducer physical features

Note:

A terminal will be marked as '**NC**' when it is not available for use. NC refers to a non-connected terminal.

4.2 Communication ports (RS-485 and USB)

The PT3 is equipped with a micro USB port. In addition the MFT variant has an RS-485 port.

- The USB point-to point connection port is used for configuring the PT3 transducer in the field. For details on configuration refer section 6.
- The RS485 communication port is used for reading instantaneous parameters using the MODBUS RTU protocol. For details refer section 9.

5 Technical specifications

Environmental and safety specifications		
Protection class	II (double insulation) EN 61010-1	
Pollution degree	2	
Ingress protection	Protection enclosure - IP 40, terminals and USB - IP 20 (EN 60529)	
Temperature	Operating range	-5 °C to + 55 °C
	Limit range for storage	-25 °C to +70 °C
	Limit range for transportation	-25 °C to +70 °C
	Temperature coefficient	± 0.1% / 10 °C
Reference conditions	Usage group (IEC 60688)	Group I
	Reference temperature range	+10°C to + 35 °C
	Pre-conditioning	30 minutes
Environment	Indoor only	
Humidity	95% non-condensing	
Altitude level	Up to 2000 m	
Over voltage / Installation category	CAT III for ≤ 300 VAC and CAT II for ≤ 600 VAC	
Measurement category	CAT III for ≤ 300 VAC and CAT II for ≤ 600 VAC	
Insulation AC voltage test (IEC 61010:2010)	3.7kV	
Impulse voltage test (IEC 61010:2010)	6.4kV	

Electrical specifications			
Transducer variant	**Parameter**	**Specification**	
AC ∿ voltage	Input voltage (U_n)	100 V to 500 V (L-L) 500 V is maximum limit.	
	Measuring range	0 to 130% U_n	
	Scale factor	0.8 to 1.5 of U_n (up to 500 V)	
	Frequency	50/60 Hz (±5%)	
	Maximum overload voltage	1.3 x U_n continuously 2 x U_n for 1 second, with up to 10 repetitions at 10 second intervals	
	Output curve	mA type	0-20 mA, 4-20 mA and 0-10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			0-5 mA

			(Applicable for accuracy class 1.0 and 0.5)
			0-1 mA and 0-2 mA (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
AC ∿ current	Input (I_n) current	1 to 5 A	
	Measuring current range	0 to 150% I_n	
	Scale factor	0.6 to 1.5 of I_n	
	Frequency	50/60 Hz (±5%)	
	Output curve	mA type	20 mA, 4-20 mA and 10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			0-5 mA (Applicable for accuracy class 1.0 and 0.5)
			0-1 mA and 0-2 mA (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
	Maximum overload current	2 x I_n continuously 20 x In for 1 second, with up to 5 repetitions at 5 minute intervals	
Active power/reactive power	Input voltage (U_n)	100 V to 500 V (L-L) 500 V is maximum limit.	
	Input voltage range	0 to 130 % U_n	
	Input current (I_n)	1 to 5 A	
	Input current range	0 to 150% I_n	
	Frequency	50/60 Hz (±5%)	
	Output curve	mA type	-20 to +20 mA, 4-20mA and -10 to +10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			-5 to +5 mA (Applicable for accuracy class 1.0 and 0.5)

			-1 to +1 mA and -2 to +2 mA, (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
	Scale factor	0.5 to 1.5 (active power at unity power factor)	
		0.3 to 1 (reactive power at reactive power factor >0.8 or unity)	
Active power factor	Input voltage (U_n)	100 V to 500 V (L-L) 500 V is maximum limit.	
	Input voltage range	0 to 130 % U_n	
	Input current (I_n)	1 to 5 A	
	Input current range	0 to 150% In	
	Frequency	50/60 Hz (± 5 %)	
	Measurement range	-1 lead-0-1 lag	
	Output curve	mA type	-20 to +20 mA, 4-20mA and -10 to +10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			-5 to +5 mA (Applicable for accuracy class 1.0 and 0.5)
			-1 to +1 mA and -2 to +2 mA, (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
Load power factor	Input voltage (U_n)	100 V to 500 V (L-L) for 3P3W 57.5 to 400 V (L-N) for 3P4W 500 V is maximum limit.	
	Input voltage range	0 to 130 % U_n	
	Input current (I_n)	1 to 5 A	
	Input current range	0 to 150% In	
	Frequency	50/60 Hz (± 5 %)	
	Measurement range	-1 lead-0-1 lag	
	Output curve	mA type	-20 to +20 mA, 4-20mA and -10 to +10 mA

			(Applicable for accuracy class 1.0, 0.5 and 0.2)
			-5 to +5 mA (Applicable for accuracy class 1.0 and 0.5)
			-1 to +1 mA and -2 to +2 mA, (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
Apparent Power	Input voltage (U_n)	100 V to 500 V (L-L) 500 V is maximum limit.	
	Input voltage range	0 to 130 % U_n	
	Input current (I_n)	1 to 5 A	
	Input current range	0 to 150% I_n	
	Frequency	50/60 Hz (±5%)	
	Output curve	mA type	-20 to +20 mA, 4-20mA and -10 to +10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			-5 to +5 mA (Applicable for accuracy class 1.0 and 0.5)
			-1 to +1 mA and -2 to +2 mA, (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
Frequency	Input voltage (U_n)	100 V to 500 V (L-L) 500 V is maximum limit.	
	Input voltage range	0 to 130 % U_n	
	Input current (I_n)	1 to 5 A	
	Input current range	0 to 150% I_n	

	Measurement range	45 Hz to 55 Hz (on 50 Hz), or 55 Hz to 65 Hz (on 60 Hz)	
	Output curve	mA type	-20 to +20 mA, 4-20mA and -10 to +10 mA (Applicable for accuracy class 1.0, 0.5 and 0.2)
			-5 to +5 mA (Applicable for accuracy class 1.0 and 0.5)
			-1 to +1 mA and -2 to +2 mA, (Applicable for accuracy class 1.0)
		V type	-5 to +5 V and -10 to +10 V (Applicable for accuracy class 1.0, 0.5 and 0.2)
MFT	Ranges applicable for configured input function (AC voltage, AC current, reactive power, active power, active power factor, apparent power, load power factor, and frequency) as per measurement inputs shown above.		

Auxiliary supply		
High-auxiliary	Voltage range	80 V to 276 V AC/DC
	Frequency	50/60 Hz
	Maximum burden	≤11 VA, 6 W with **two** outputs at 750 Ω each at 20 mA ≤12 VA, 7 W with **four** outputs at 750 Ω each at 20 mA
Low-auxiliary	Voltage range	24 V to 80 V DC
	Maximum burden	≤6 W with **two** outputs at 750 Ω each at 20 mA ≤8 W with **four** outputs at 750 Ω each at 20 mA

Standards compliance	
Standards complied	IEC 60688 (Edition 3.0) : 2012, IEC 61010-1 (Edition 3.0) : 2010, IEC 61010-2-030 (Edition 1.0) : 2010, IEC61326-1(Edition-2) : 2012, IEC or EN60068-2-1/-2/-3/-6/-27

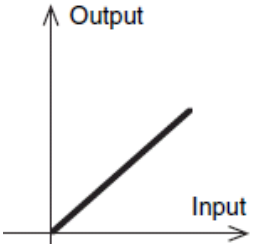
Analogue outputs	
Type	Current or Voltage (configurable)
Maximum load impedance	≤750 Ω for 20 mA, ≥2 kΩ for 10 V (for each output)

Response time	At 5 cycles measurement ≥100 ms to ≤ 220 ms
Ripple	< 0.4% peak to peak, at 20 mA

Mechanical specifications	
Product dimensions (W x H x D)	100 mm x 75 mm x 105 mm
Weight	0.7 kg (approx.)
Material	Flame-retardant polycarbonate (PC-FR), UL94 V-0
Mounting	Top hat DIN Rail mountable as per EN 50022
Connector type	Screw terminals
Conductor size for terminals	≤4 mm^2 (solid max.)
Connection cables (recommended size)	2.5 mm^2
Recommended torque	0.5 N m
Impact rating (IK code)	IK06
Impact energy level	1 joule

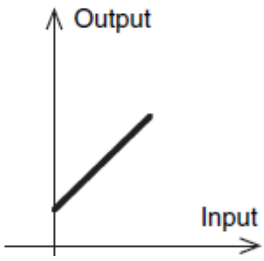
5.1 PT3 output signals

1. Curve A (linear)



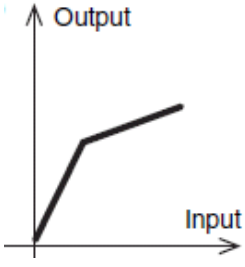
Example 0-10 mA corresponding to 0-100 A

2. Curve B (linear with live zero)



Example 4-20 mA corresponding to 0-100 A

3. Curve F (compressed upper region)



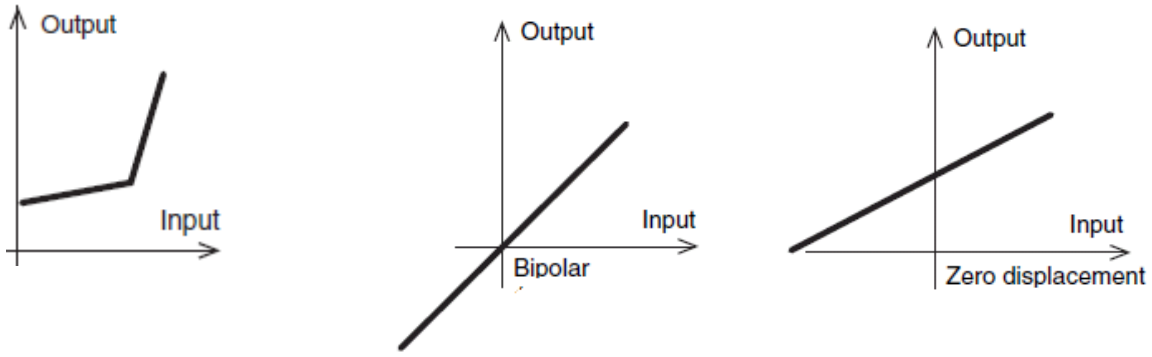
Example 0-16-20 mA corresponding to 0-200-800 A

4. Curve F (compressed lower region with live

5. Curve C (Bipolar)

6. Curve D (Bipolar with live zero)

zero)



Example 4-6-20 mA corresponding to 0-8-12 kV

Example (-10)-0-10 mA corresponding to (-100) -0-100 kW

Example 0-5-10 mA corresponding to (-100) -0-100 kW

Figure 2: PT3 transducer output curves

6 Configuring PT3 transducers

Configuration means setting up the programmable features in a device, in order to make it suitable for a particular application. To configure PT3 transducers, you must have the latest version of ConfigView software installed on your PC or laptop device. This software may be downloaded free of charge from our website: www.securemeters.com.

PT3 transducers can be configured either in online or offline mode.

6.1 Procedure to configure PT3 in Online mode

To configure the transducer device in online mode, a physical connection must be established between the transducer and the PC /laptop with ConfigView. The process for configuration is described below:

1. Connect the PC /laptop to the micro USB port on the PT3 transducer using a suitable cable.

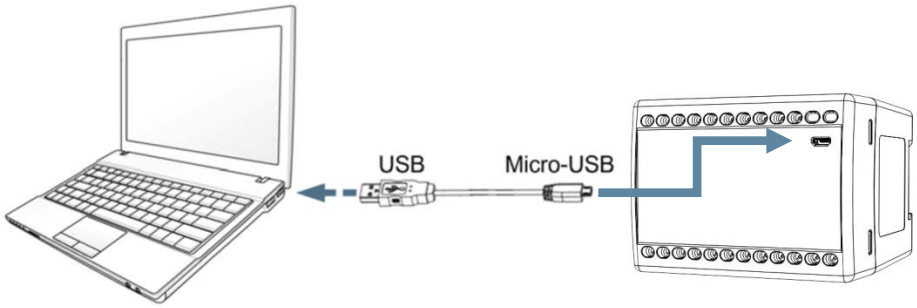


Figure 3: Establishing connection between PT3 and ConfigView

2. Launch the ConfigView software.
3. Establish the connection between ConfigView and the transducer. For details on how to make the connections, refer the ConfigView help file.
4. Once connected, the existing configuration of the connected transducer device is displayed in ConfigView.
5. Make the required changes and click the **Apply** button.
6. If required, the customer serial number of the transducer can be changed from ConfigView. A label can also be printed for the new configuration applied. For both the procedures, refer the sections 6.3 and 6.4 respectively.
7. Perform a power cycle reset (Power OFF-ON) of the transducer device for the new configuration to take effect.

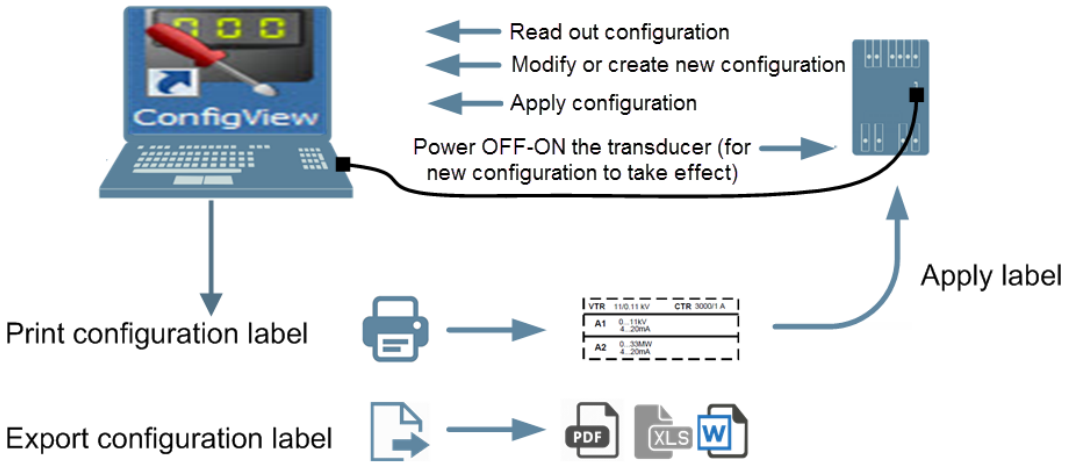


Figure 4: Configuring PT3 in online mode

Note: Please refer the ConfigView user manual for detailed settings that can be configured in the PT3 transducers.

6.2 Procedure to configure PT3 in Offline mode

In this mode, a configuration file is generated in ConfigView and saved in the computer or laptop. This configuration can be transferred to the transducer device by establishing a physical connection at any later time. Please ensure that the configuration file includes the correct product code details of the transducer to be configured. In case of incorrect product code, the device will reject the configuration file.

To perform the configuration in offline mode, do the following:

1. Launch the ConfigView software.
2. Create a new configuration file or open an existing configuration file.
3. Make the required modifications.
4. Save the file.

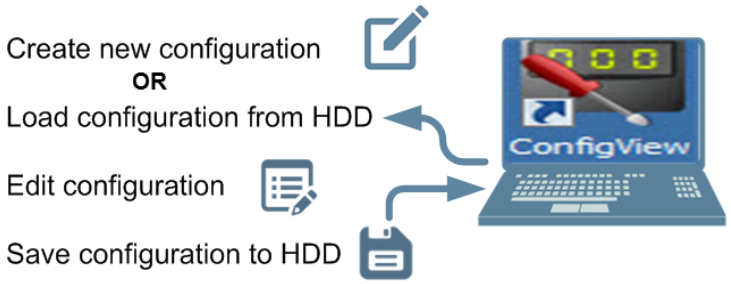


Figure 5: Configuring PT3 in offline mode

5. The rest of the procedure is the same as that described for online mode under section 6.1. The only difference is that you need to select the saved configuration file and apply it to the transducer device.

Note:

Multiple transducers can be configured using a single configuration file generated in offline mode.

6.3 Changing the customer serial number in the transducer

If required, the serial number of the transducer device can be changed when the transducer is connected to ConfigView via a USB cable.

To change the customer serial number on the transducer using ConfigView, do the following:

- In the **Settings** menu, click **Change Customer Serial No.**
- Set the customer serial number to any combination of eight alphanumeric characters.
- Type the required customer serial number in the **Change Customer Sr. No.** box, and then click **Save**.

6.4 Printing/exporting label for PT3 transducer

A label stating the configuration details can be printed out and pasted on the PT3 transducers. This can be done directly from ConfigView, if a transducer is connected via USB cable.

To print/export the label from ConfigView, do the following:

- Click the 

icon in the toolbar.
- The printer settings can be adjusted, or the file can be exported in Word, Excel or PDF formats.
- To export the file, click the  icon in the **Print** screen toolbar.
- A previously exported label can be printed using Word, Excel or Acrobat Reader.
- Cut the printed label around the dotted line and then stick it on the PT3 transducer.

7 Installing PT3 transducers

7.1 PT3 transducer dimensional details

The overall dimensions of PT3 transducers are shown below.

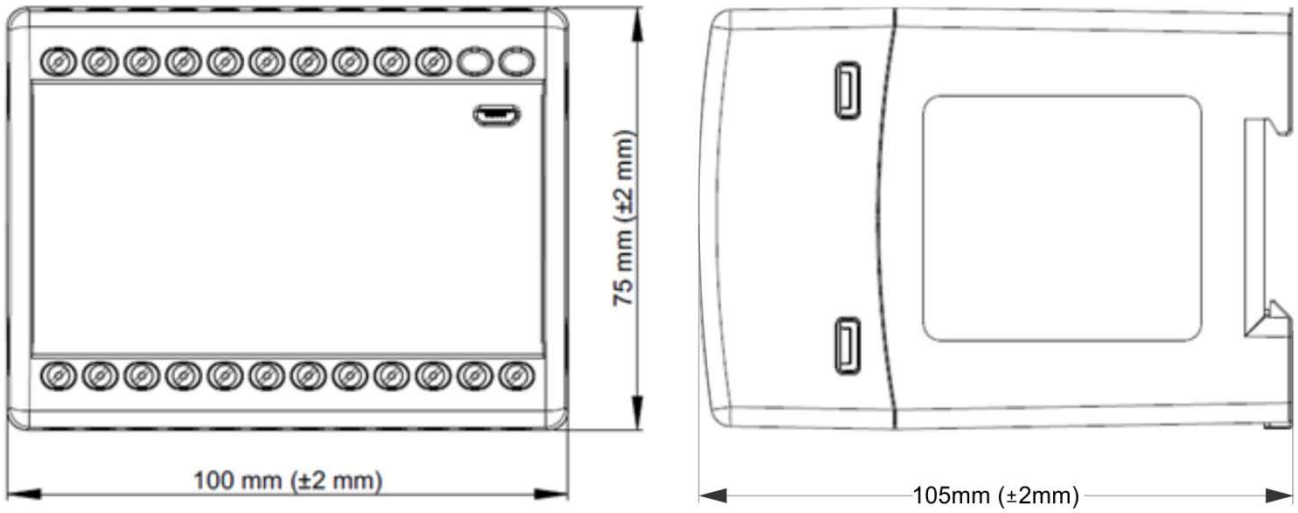


Figure 6: PT3 transducer dimensions

7.2 Mounting the PT3 transducer on a DIN rail

To mount the PT3 transducer on a DIN rail, hook one edge of the rail with the top edge of the cut out located at the rear of the device.

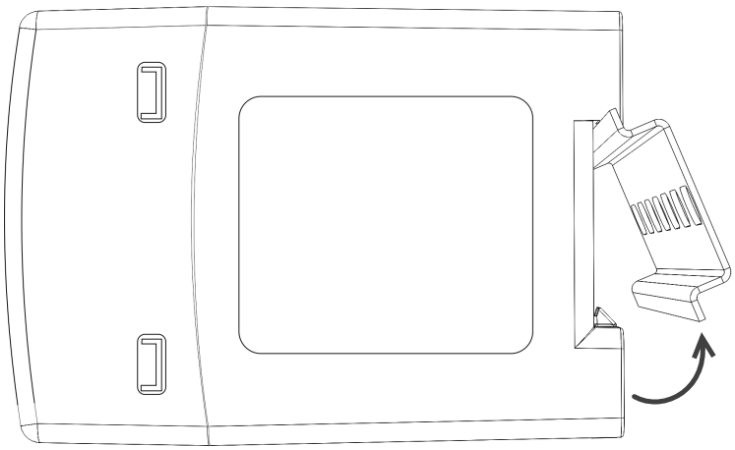


Figure 7: Aligning PT3 transducer on DIN rail

Press the device against the bottom edge of the DIN rail until the locking mechanism engages firmly in place with the release clip at the rear.

Check that the device is securely fixed.

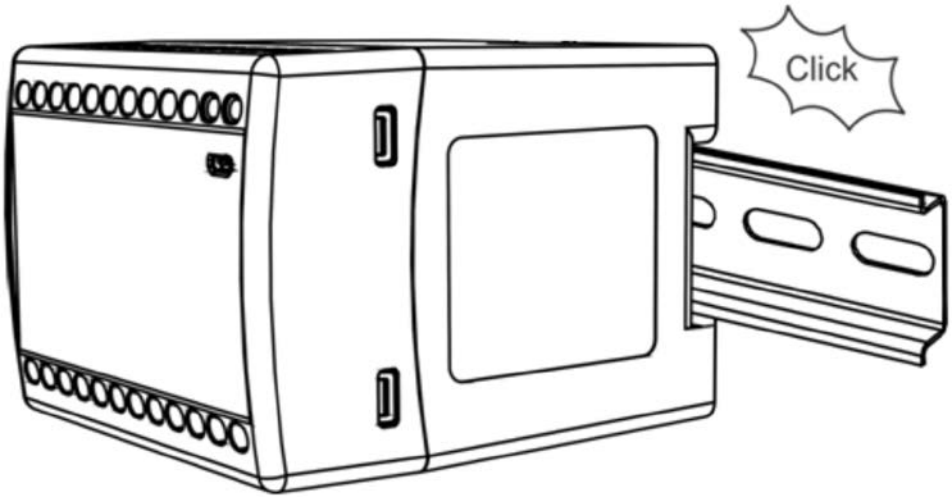


Figure 8: PT3 transducer mounted on DIN rail

7.3 Demounting the PT3 transducer

To remove or reposition the transducer device, lever up the release clip with a screwdriver, and then lower the device off and away from the rail.

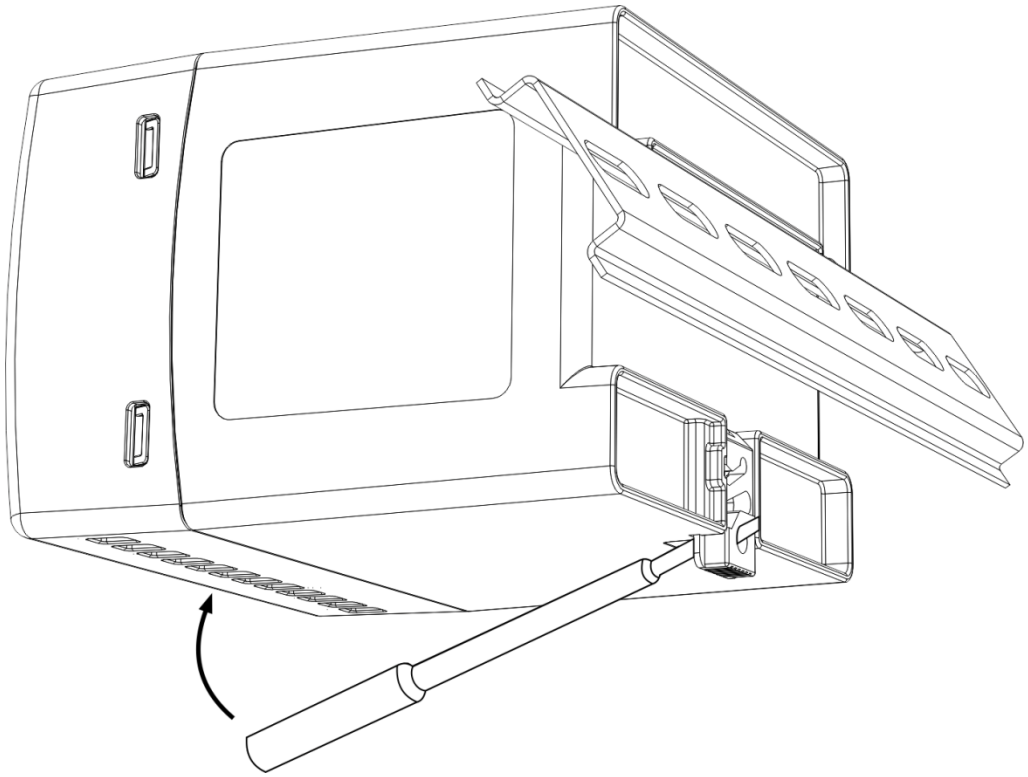
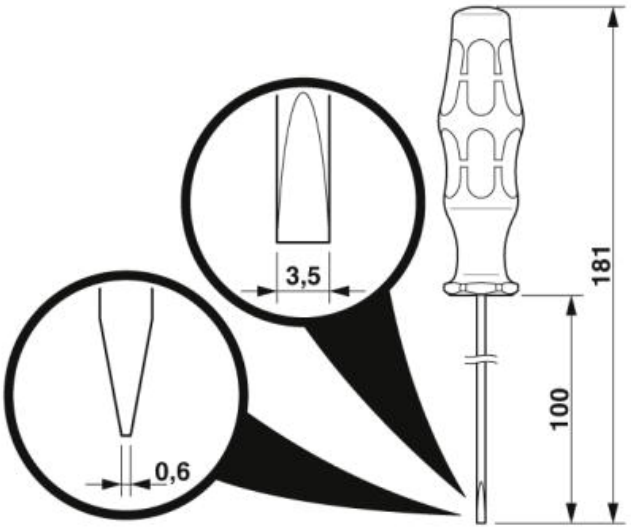


Figure 9: Demounting the PT3 transducer

Note:

To prevent damage to the screw heads when tightening the screws, it is highly recommended to use a torque controlled screw driver with appropriate bit size. A recommended screw driver with bit size is illustrated below.



8 PT3 network connections

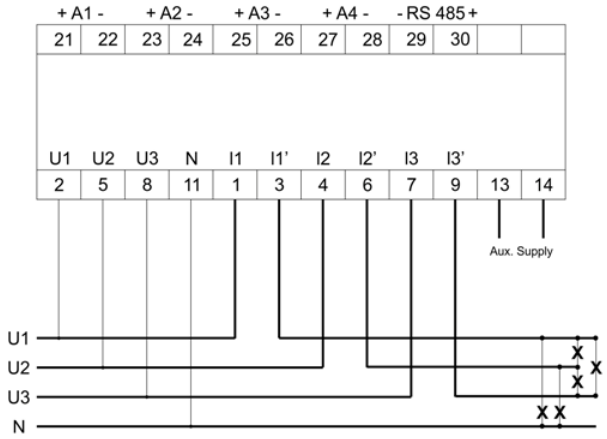
Physical connections to the PT3 with the network are made on the front of the transducer. The connections are: measuring voltages, measuring currents, analogue outputs, auxiliary power and connections to RS-485 communication module.

The connections must be performed in accordance with the measurement method and wiring settings configured in the transducer. Choose the corresponding connection diagram from the figures below and ensure that the correct polarity is followed.

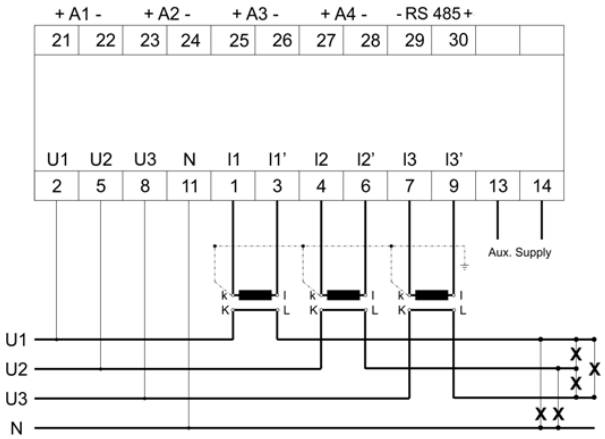
Note:

The recommended size of the connection wires is 2.5 mm^2 and the terminal depth is 8 mm. Ensure that the connections are made in accordance with the applicable regulations and best practices.

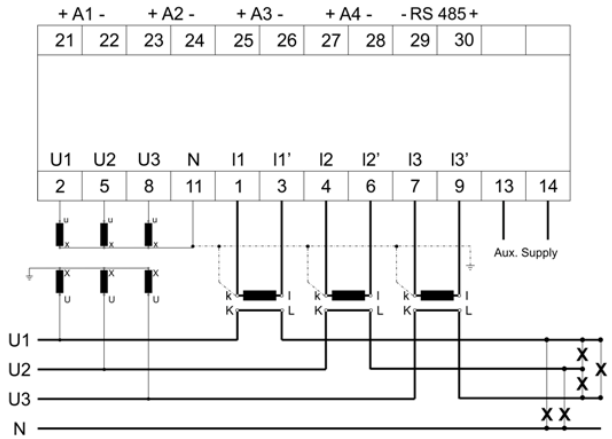
Four-wire system, three element asymmetric load (Y)



Direct connected

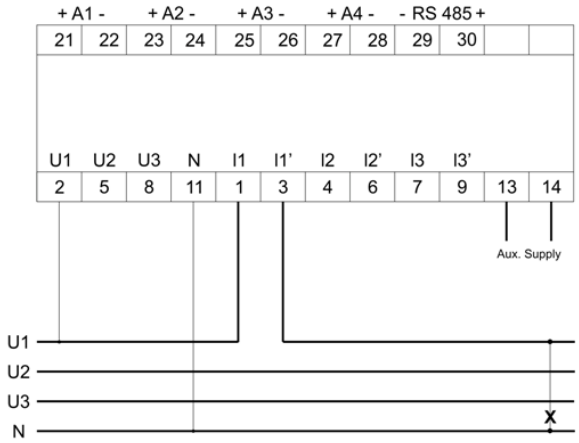


Direct connected voltages and external current transformers

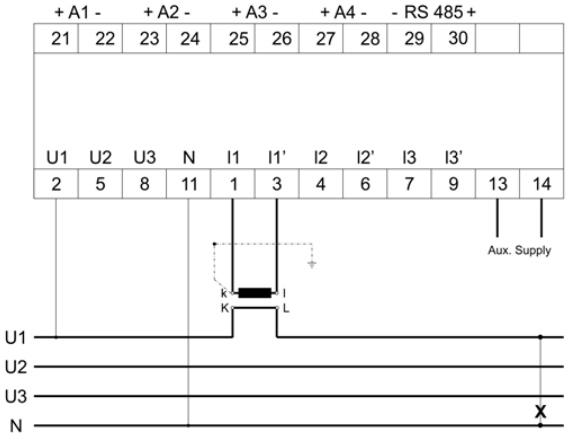


External voltage and current transformers

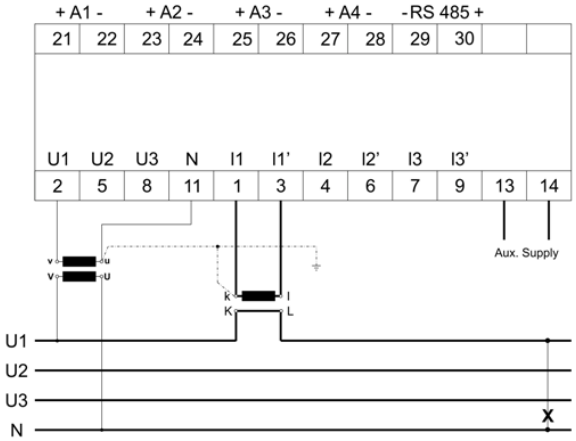
Four-wire system, three element balanced load (U1-I1)



Direct connected

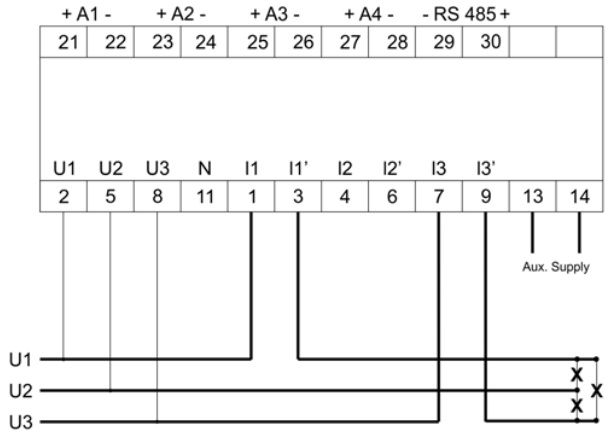


Direct connected voltage and external current transformer

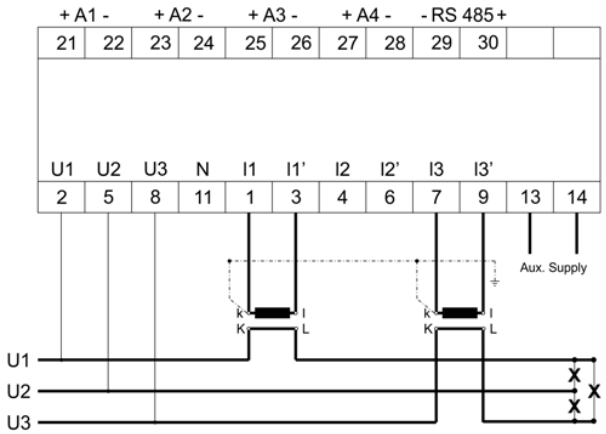


External voltage and current transformers

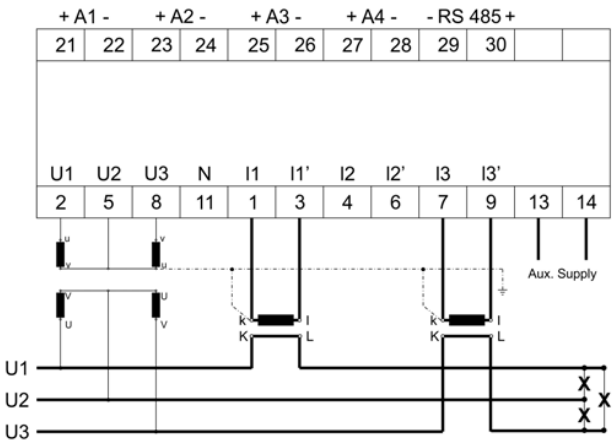
Three-wire system, two element asymmetric load (D)



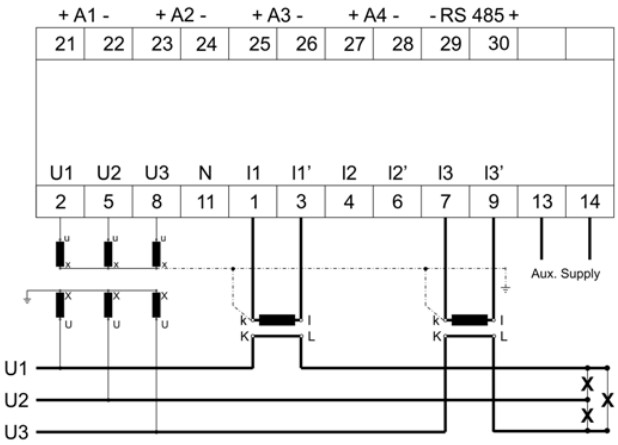
Direct connected



Direct connected voltages and external current transformers

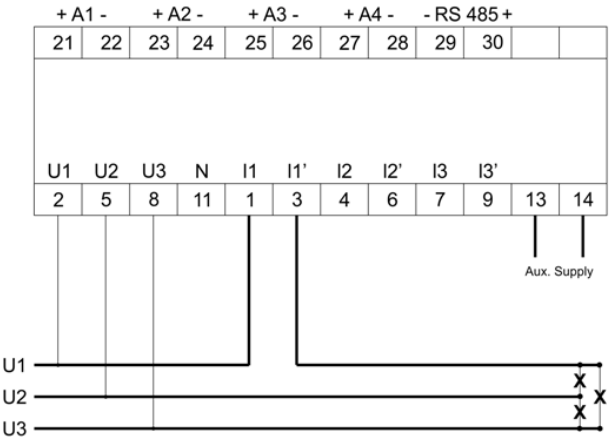


Two external voltage and current transformers

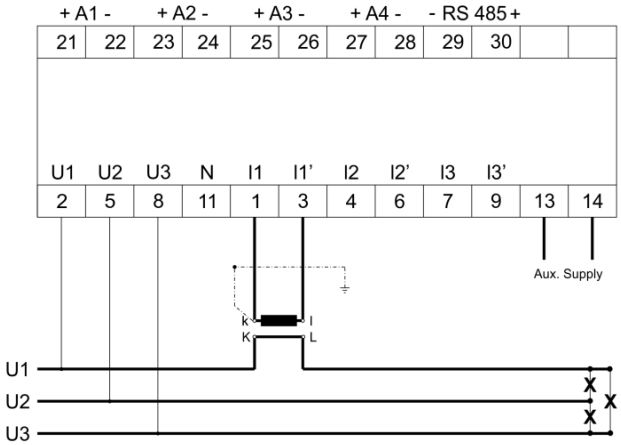


Three external voltage transformers and two current transformers

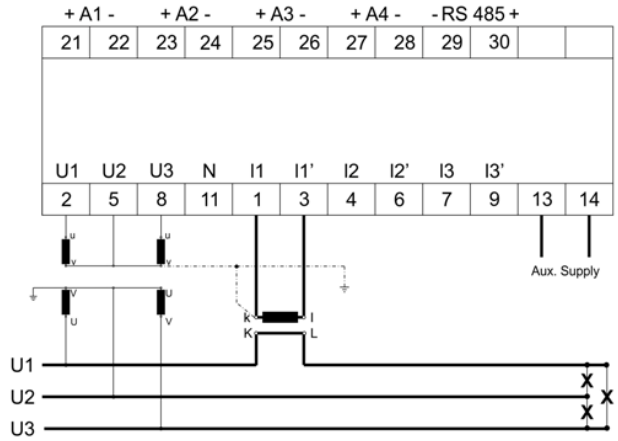
Three-wire system, two element balanced load (U12-U23-L1)



Direct connected

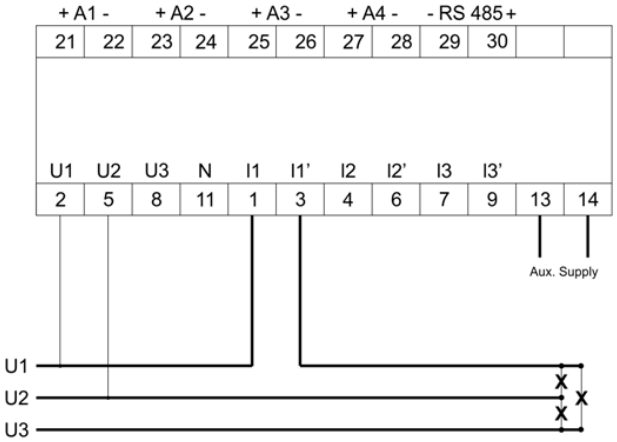


Direct connected voltages and external current transformer

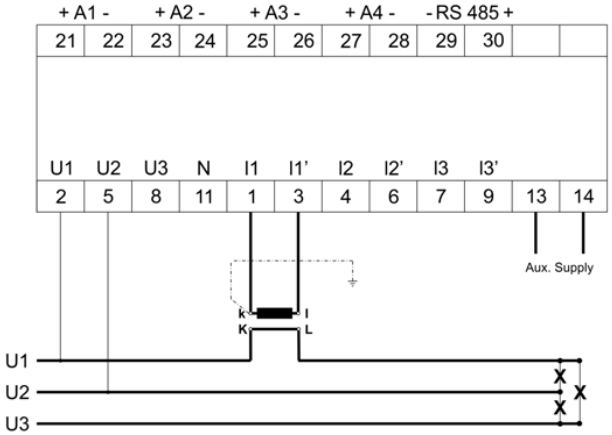


External voltages and current transformers

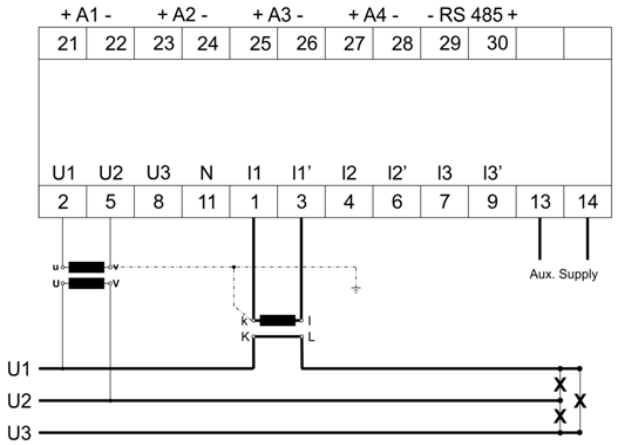
Three-wire system, two element balanced system (U12-L1)



Direct connected

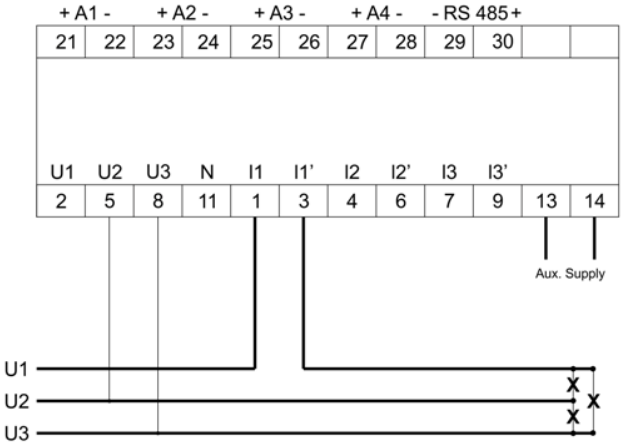


Direct connected voltage and external current transformer

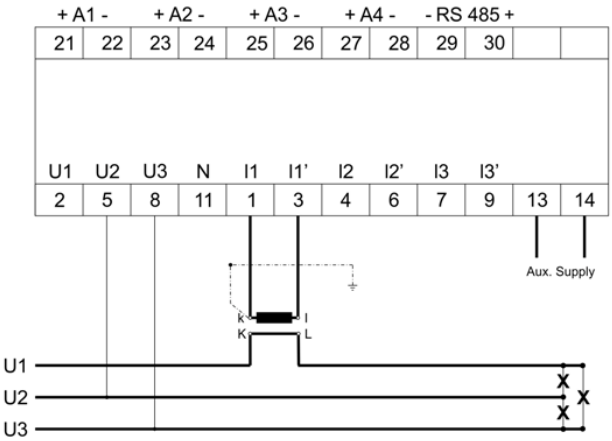


External voltage and current transformers

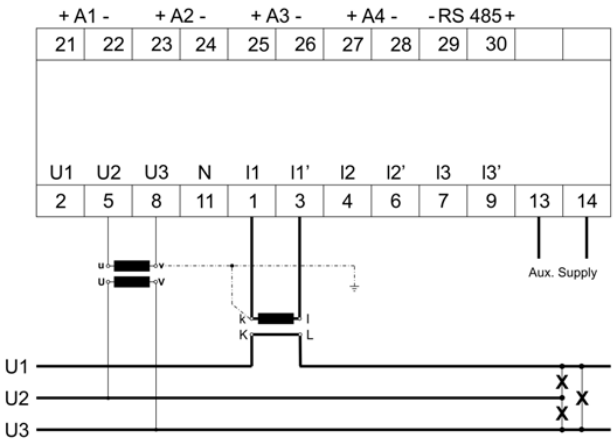
Three-wire system, two element balanced system (U23-L1)



Direct connected

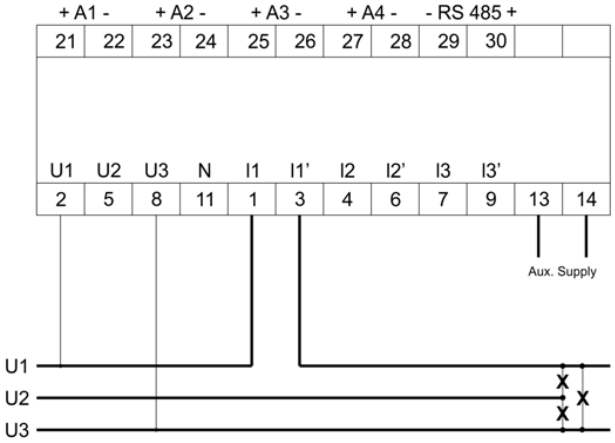


Direct connected voltage and external current transformer

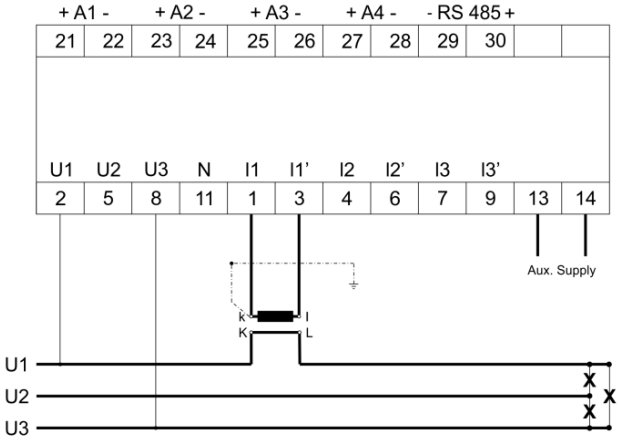


External voltage and current transformers

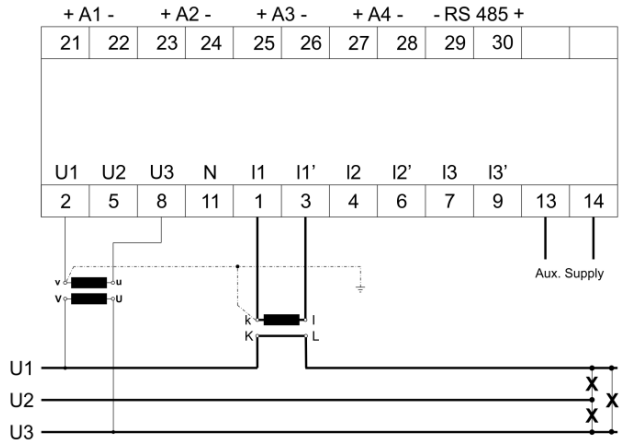
Three-wire system, two element balanced system (U31-L1)



Direct connected

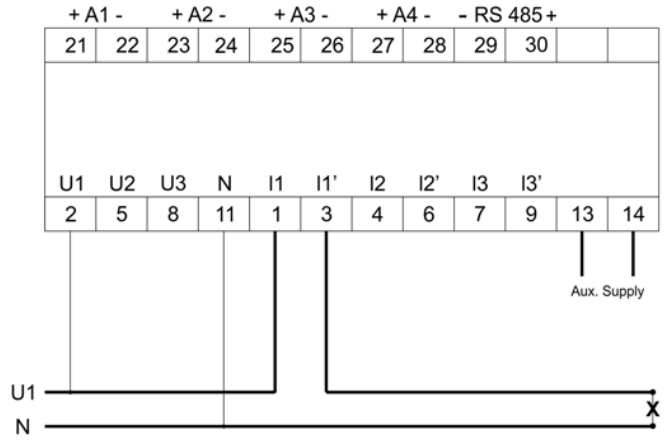


Direct connected voltage and external current transformer

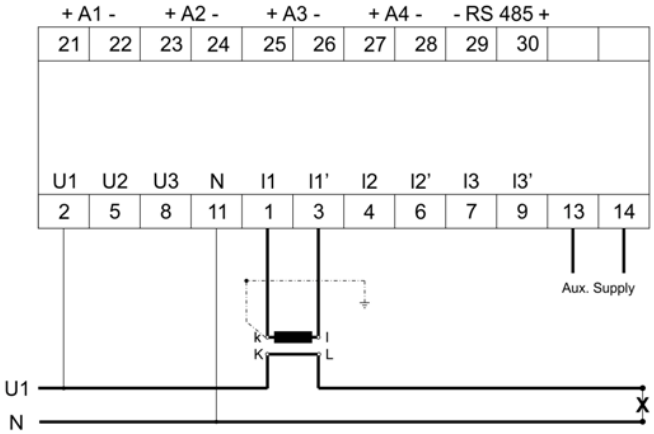


External voltage and current transformers

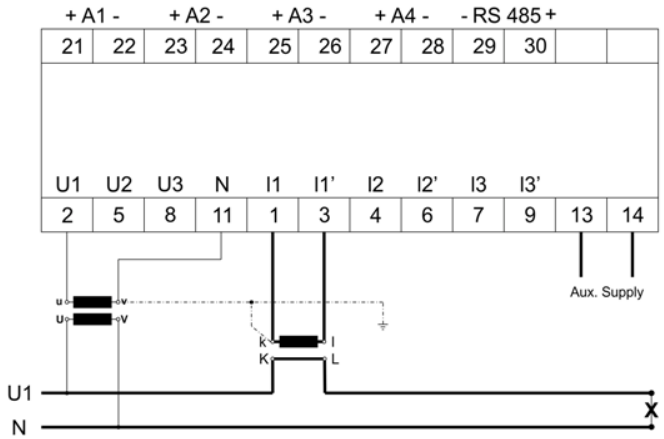
Single phase system



Direct connected



Direct connected voltage and external current transformer



External voltage and current transformers

Note:

Please connect a 750 ohm resistor across any unused analogue outputs.

9 Modbus mapping

9.1 Introduction

The PT3 multi-function transducer variant is included with an RS-485 port to enable reading of instantaneous parameters such as line voltages, current and power over Modbus protocol. The data stored in various holding registers can be read from the transducer device at any given time by sending a request through a supported controller device. For the purpose of data transmission, a multi-drop RS485 or point to point network of the PT3 devices is established over a Modbus line, which makes it easy to acquire data from multiple or single devices. Mapping of various parameters must be done to enable data transmission over Modbus.

9.2 References

- Modbus Application Protocol Specification V1.1b
- MODBUS over Serial Line Specification and Implementation Guide V1.02 by Modbus-IDA.ORG

9.3 Modbus settings

9.3.1 Connections

Up to 32 PT3 transducers and one controller device can be connected within an RS485 multi-drop network. Data can be robustly communicated over a distance of up to 1 kilometer on this network by connecting devices using twisted pair shielding cables.

To match the impedance of the termination load with the cable impedance, it is necessary to terminate both ends of the line. This can be achieved by applying a resistor of 120 ohm at both ends.

9.3.2 Slave address

The permissible Modbus slave ID range for the PT3 transducer is between 1 and 247 for 32 instruments. Broadcast mode (address 0) is not allowed.

9.3.3 Register addresses

In the PT3 transducer, data is stored in different registers. This data can be read by communicating with the transducer on the RS485 port over standard Modus protocol. Each parameter has a separate register address. For example, the system frequency value is stored in a fixed register 43019 and Active power on phase L1 in register 43033. (For details refer section 0)

By default, the PT3 has a Modbus slave ID set to‘1’ and baud rate set to 9600 bps. Both of these can be reconfigured using ConfigView. A Power OFF-ON is required in the transducer device for the changes to take effect after the ID is reset.

Register a*ddresses for different data parameters mentioned in this document should be queried with a +1 to get a protocol data unit (PDU) or data package. To receive a Modbus PDU address, 1 should subtracted from the register addresses mentioned in this document.*

For example, to receive a PDU for the data element ‘Measuring system’, which has an address of ‘43009’, a query with 43010 must be sent.

9.3.4 Serial port settings

The following serial port settings are required to communicate with the PT3 transducer on the RS-485 port:

- Parity - None
- Stop Bits - 1
- Baud rate - 1200, 2400, 4800, 9600, 14400, 19200, or 38400. Choose the setting as configured in the transducer device. ConfigView can be used to read or configure the desired baud rate.
- Data Bits - 8

9.3.5 Modbus function codes

The transducer supports the function code ‘03’ to read holding registers. To read parameter values stored in holding registers, a controller device sends a request to the slave device (transducer). This request specifies the start register address and the number of registers to be read out. The start register is numbered from zero (for example, 40001 = zero, 40002 =one, etc.). The transducer responds with a packet containing the values of the registers in the range defined in the request.

9.3.5.1 Modbus mapping compatibility with different firmware versions

To read parameter values on Modbus from PT3 transducers supplied with firmware version **'TRDTB02',** you will need to retain prefix **‘4’** in the register mapping as an input for reading parameters. For example, ‘**43018**’

9.3.6 Registers

The following register types are available in PT3:

9.3.6.1 Fixed information registers

Tabulated below are the fixed information registers available in the PT3 transducer for storing different parameter data types:

Register address (in decimal)	Size (in bytes)	Parameter	Format
43001	2	Modbus slave ID	Unsigned 16 bits
43002	2	Baud Rate	Unsigned 16 bits
43003	2	Stop Bits 1	Unsigned 16 bits
43004	2	Parity - NONE	Unsigned 16 bits
43005	2	MODBUS version, revision	Unsigned 16 bits
43006	2	Supported general information register	Unsigned 16 bits
43007	2	Modbus data format 00- Hex (Not Available. For future use) 01- 32 Bit Floating Point Format	Unsigned 16 bits
43008	2	Product type	ASCII (8 byte)
43009	2	Measuring system	Unsigned 16 bits
43010	2	Number of polls	Unsigned 16 bits
43011 to 43014	8	Transducer serial number	ASCII (8 byte)
43015 to 43018	8	Firmware name	ASCII (8 byte)

9.3.6.2 Standard registers (For instantaneous parameters)

All calculated values are represented as two consecutive Modbus registers. The value of a quantity is represented as a single precision floating point number according to IEEE 754, in SI unit.

Register address (in decimal)	Size (in bytes)	Parameter	Format
43019 to 43020	4	Frequency	32 bits FP
43021 to 43022	4	U1 voltage (L-N) / U12 (L-L)	32 bits FP
43023 to 43024	4	U2 voltage (L-N) / U23 (L-L)	32 bits FP
43025 to 43026	4	U3 voltage (L-N) / U31 (L-L)	32 bits FP
43027 to 43028	4	I1 current	32 bits FP
43029 to 43030	4	I2 current	32 bits FP
43031 to 43032	4	I3 current	32 bits FP
43033 to 43034	4	Active power on phase L1	32 bits FP
43035 to 43036	4	Active power on phase L2	32 bits FP
43037 to 43038	4	Active power on phase L3	32 bits FP
43039 to 43040	4	Reactive power on phase L1	32 bits FP
43041 to 43042	4	Reactive power on phase L2	32 bits FP
43043 to 43044	4	Reactive power on phase L3	32 bits FP
43045 to 43046	4	Apparent power on phase L1	32 bits FP
43047 to 43048	4	Apparent power on phase L2	32 bits FP
43049 to 43050	4	Apparent power on phase L3	32 bits FP
43051 to 43052	4	Active power factor phase L1	32 bits FP
43053 to 43054	4	Active power factor phase L2	32 bits FP
43055 to 43056	4	Active power factor phase L3	32 bits FP
43057 to 43058	4	Power factor angle L1	32 bits FP
43059 to 43060	4	Power factor angle L2	32 bits FP
43061 to 43062	4	Power factor angle L3	32 bits FP
43063 to 43064	4	Load power factor phase L1	32 bits FP
43065 to 43066	4	Load power factor phase L2	32 bits FP
43067 to 43068	4	Load power factor phase L3	32 bits FP
43069 to 43070	4	System voltage V = (V1+V2+V3)/3	32 bits FP
43071 to 43072	4	System current I = (I1 + I2 + I3)/3	32 bits FP
43073 to 43074	4	Active power of the system P = P1 + P2 + P3	32 bits FP
43075 to 43076	4	Reactive power of the system Q = Q1 + Q2 + Q3	32 bits FP
43077 to 43078	4	Apparent power of the system S = S1 + S2 + S3	32 bits FP
43079 to 43080	4	System power factor L1,L2,L3	32 bits FP
43081 to 43082	4	System power factor load L1,L2,L3	32 bits FP

9.4 Supported reading parameters for different PT3 network connections

The following table shows a list of parameters that can be read for each network type. Values of parameters not supported by a specific network can be read but may not be displayed correctly. Such parameters are not marked with any symbol in the table.

Please note the meaning of the following symbols:

✔	The parameter can be configured for analogue outputs using ConfigView. These can be read over Modbus and ConfigView.
*	The parameter can be read only on Modbus.

	Single phase L1	Three wire, 2-element asymmetric (D)	Three wire, 2-element balanced U12,U23,L1	Three wire, 2-element balanced U12, L1	Three wire, 2-element balanced U23, L1	Three wire, 2-element balanced U31, L1	Four wire, 3-element asymmetric (Y)	Four wire, 3-element balanced
Available Parameters								
Frequency	*	*	*	*	*	*	*	*
V1 (L-N)	✔						✔	*
V2 (L-N)							✔	*
V3 (L-N)							✔	*
V1 (L-L)		✔	✔	✔	*	*		
V2 (L-L)		✔	✔	*	✔	*		
V3 (L-L)		✔	✔	*	*	✔		
I1	✔	✔	*	*	*	*	✔	*
I2		✔					✔	*
I3		✔	*	*	*	*	✔	*
Active Power (Ph1)	✔						✔	*
Active Power (Ph2)							✔	*
Active Power (Ph3)							✔	*
Reactive Power (Ph1)	✔						✔	*
Reactive Power (Ph2)							✔	*
Reactive Power (Ph3)							✔	*
Apparent Power (Ph1)	✔						✔	*

Apparent Power (Ph2)							✔	*
Apparent Power (Ph3)							✔	*
Power Factor (Ph1)	✔						✔	*
Power Factor (Ph2)							✔	*
Power Factor (Ph3)							✔	*
Power Factor (angle 1)							*	*
Power Factor (angle 2)							*	*
Power Factor (angle 3)							*	*
System Voltage							✔	✔
System Current	*	✔	✔	✔	✔	✔	✔	✔
System Active Power	*	✔	✔	✔	✔	✔	✔	✔
System Reactive Power	*	✔	✔	✔	✔	✔	✔	✔
System Apparent Power	*	✔	✔	✔	✔	✔	✔	✔
Power Factor	*	✔	✔	✔	✔	✔	✔	✔

9.5 Reading holding registers

The latency period or the maximum time duration taken by the PT3 transducer to process a query request by a controller device is 1 sec. This duration is applicable for a transducer operating at 9600 baud rate and responding to a maximum length query. The PT3 data refresh rate for communication over Modbus is also 1 second.

The following table shows the Read Holding Registers request and response packet formats, and an example transaction.

Read Register Request Packet (Controller to Transducer)		**Read Register Response Packet (Transducer to Controller)**	
Unit ID/Slave Address	(1 byte)	Unit ID/Slave Address	(1 byte)
03 -Function code	(1 byte)	03 (Function Code)	(1 byte)
Start Register (SR)	(2 bytes)	Byte Count (2 x nr)	(1 byte)
Number of Registers to Read (NR)	(2 bytes)	First Register in range	(2 bytes)
CRC Checksum	(2 bytes)	Second Register in range	(2 bytes)
		.....	
		Up to register ‘n’ in range	(2 bytes)
		CRC Checksum	(2 bytes)

Example: Reading holding registers

The transducer is configured as a Modbus slave device, with a slave address of 15. The Master requests to read holding registers 43001 to read the configured “Modbus Slave ID” (parameter is stored in an Unsigned 16 bit format, hence requires 1 registers or 2 bytes).

Request Packet

Slave address	**Function**	**Start Register Hi**	**Start Register Lo**	**Count Hi**	**Count Lo**	**CRC**	
0F	03	0B	B9	00	01	High	Low

Response Packet

Slave address	**Function**	**Byte Count**	**Reg. 1 Hi**	**Reg. 1 Lo**	**CRC**	
0F	03	02	00	0F	High	Low

Exceptions

Exception codes help identify possible causes for unsuccessful data response against requested queries. If a MODBUS master device sends an invalid command to the transducer, or attempts to read an invalid holding register, an exception response is generated. An exception may also be generated for other errors such as an attempt to set floating point variable to an invalid value. The exception response follows the standard packet format. The high-order bit of the function code in an exception response is set to 1.

The data field of an exception response contains the exception error code. The table below describes the exception codes supported by the PT3 and their possible causes.

Sr. No.	Error description	Error code
1.	Illegal function	01
2.	Illegal address	02
3.	Illegal frame size	04
4.	CRC fail	16

Example: Error response when read invalid address

The transducer is configured as a Modbus slave device, with a slave address of 240. If the Master requests to read holding registers 42020, which is the invalid address. Exception response 02 will be replied by slave.

Request packet

Slave address	Function	Start Register Hi	Start Register Lo	Count Hi	Count Lo	CRC Hi	CRC Lo
F0	03	07	E4	00	0C	-	-

Response packet

Slave address	Function	Exception code	CRC Hi	CRC Lo
F0	83	02		

10 Troubleshooting

Problem	Possible cause	Check
The transducer does not seem to be working.	Auxiliary power may not be connected or energised	Check the auxiliary supply. The **ON** LED on the front panel glows green when the unit is powered by the auxiliary supply.
A1 (or **A2, A3 or A4**) LED on the front panel is glowing red	The mA analogue output loop is open-circuit or voltage analogue output loop is short circuit	If the current mA analogue output is open circuit, connect a load resistor ≤ 750 ohm across the terminals (+A1-, +A2-, +A3-, or +A4-) and if the voltage analogue output is short circuit, connect a load resistor ≥ 2k ohm across the terminals (+A1-, +A2-, +A3-, or +A4-). Verify the LED operation by applying an input as per specified ranges.
Transducer is connected and powered by auxiliary supply, but the new configuration has not taken effect.	Transducer needs a power-OFF-ON for new configuration to take effect.	Power OFF the auxiliary supply for a few seconds and then Power ON. The new configuration is now activated for reading.
Configuration and **Reading** modes are not working. ConfigView reports an error ‘Unable to show the page’.	Transducer not connected by USB.	Connect the transducer to USB port, then click **Connect**, and then select COM port. It may be necessary to load the USB driver (supplied with ConfigView).
The transducer is connected via USB cable, but no values are shown in Reading mode.	The auxiliary supply may not be connected or energised. The inputs may not be	Check the auxiliary supply. The **ON** LED on the front panel must glow Green. If the values are all zeroes, check the input connections.

	connected.	
The output level is about one fifth or five times the expected value, although the input signal is healthy, and the correct primary scaling has been applied.	The current input configuration secondary may be set incorrectly.	Check the selection for **Current Secondary**. Current and derived power values will be reported low if a CT with 1 A secondary is connected to inputs set for 5 A. They will be reported high if the condition is reversed.
The output level from the transducer is lower or higher than expected, although the input signal is healthy and the correct primary and secondary scaling has been applied.	The phase inputs may be connected incorrectly. The wiring configuration may be incorrectly selected.	Check that the physical connections for each phase and ensure that phase 1 is connected to L1 inputs, phase 2 to L2 inputs, and phase 3 to L3 inputs. Check the selection for **Measurement method**, **wiring** and **connection diagram**.
There is some doubt related to accuracy of input and output measurements	The transducer is not measuring as per configured input and output range	Measure the input and output of the transducer using a suitable measurement device. The device being used must support the measurement ranges configured in the transducer. By comparing the result with configured input and output ranges, any deviation can be easily detected

11 Frequently asked questions (FAQs)

When installing a PT3 transducer, what is the best order in which to do things?	This is a very flexible process, which can be done in a number of ways, but the simplest sequence is as follows: 1. Connect the PT3 transducer to ConfigView, via a USB cable 2. Configure the required parameters, then print out the configuration label and stick it on to the PT3 transducer (if required) 3. Clip the PT3 transducer onto the DIN rail in the panel 4. Connect the inputs, outputs and auxiliary supply to the PT3 transducer 5. Power up the auxiliary supply (this will activate the new configuration in the PT3 transducer) 6. Check the configured parameters in the PT3 transducer on Configuration screen of ConfigView. 7. Check the operation of the PT3 transducer, if the inputs are activated on the Reading screen of ConfigView.
ConfigView reported an error about the USB driver	Please ensure that the USB RS-232 emulator (driver) is installed on your system. This driver is available free of charge on the www.securemeters.com website.
Can PT3 transducer be configured without connecting the auxiliary supply?	Yes. Connect the PT3 transducer to a USB port on your PC, which will supply power as well as allow you to read and modify the configuration settings.
Does the USB port on the PT3 transducer support Modbus protocol?	No.
Does the PT3 transducer have an RS-485 output port?	Yes. The PT3 multi-function variant has an RS-485 output port.
What does the scale factor on a transfer characteristic	By default, the scale factor is unity, so the maximum value on the output is the same as the primary scaling for the input. The scale factor lets you set the value of the output to a higher or lower value, to cater for overload, or to focus

do?	lower down in the output range.
What does a breakpoint on a transfer characteristic do?	Without a breakpoint, the transfer characteristic between input and output is purely linear. A breakpoint allows the curve to be adjusted for non-linear characteristics. For example, this can be done to apply a correction for a deficiency in a sensor, or to ‘roll off’ the sensitivity at the top end.

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