# Programmable Multifunction Transducer (PMT-9)

Instrument Division

Data sheet No.: PMT-9 /10/11

The PMT-9 Multifunction Programmable Transducer measures the several variables of an electric power system and process them to produce 4 analog output signals. 2 digital output signals are available for signaling the limits or energy metering pulses. The limits of the outputs can be set by individual measurand or logically combine up to three measurands.
The principle of measuring is Dedicated DSP Controller for best calculation of Power, RMS values and Energy.

The PMT-9 is equipped with USB serial port interface through which using the corresponding software one can connect, program, or access and execute useful ancillary functions.
The ancillary functions include a power system check, provision for displaying the measured variably on a PC monitor, the simulation of the outputs for test purposes and a facility for printing nameplates.

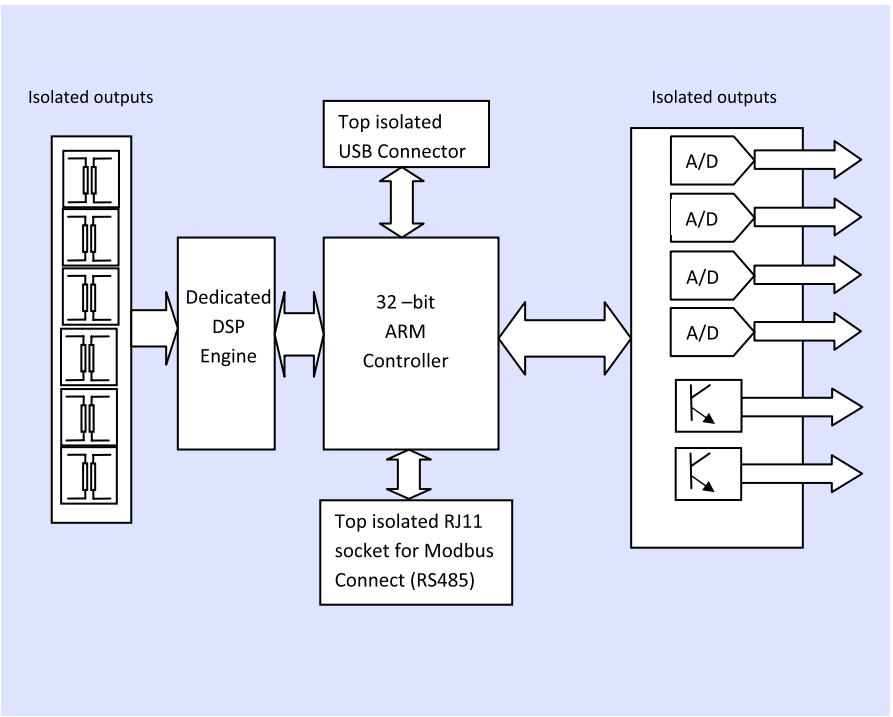
PMT-9 also equipped with a RS 485 bus interface (MODBUS®). The RS 485 interface enables the user to determine the number of variables to be supervised (up to the maximum available). The levels of all internal energy meters that have been configured can also be viewed. Provision is made for programming the PMT-9 via the bus. A standard EIA 485 interface can be used, but there is no dummy

## Features

Simultaneous measurement of several variables of a heavy-current power system / Full supervision of an asymmetrically loaded four wire power system, rated current 1 to 6 A, rated voltage 57 to 400V (phase-to-neutral) or 100 to 693 V (phase-to-phase)For all heavy-current power system variables

- Fully Programmable CT and PT Ratio.
- 4 analogue outputs
- 2 Digital Outputs
- Conversion of a current to a voltage output or vice versa is also possible without any hardware change.
- Input voltage up to 693 V (phase-to-phase)
- Universal analogue outputs (programmable)
- High accuracy: U/I 0.2% and P 0.25% (under reference conditions)
- 12 integrated energy meters.
- Windows software with password protection for programming, data analysis, power system status simulation, acquisition of meter data and making settings
- AC/DC power supply / Universal
- Compact in size.
- Provision for either snapping the transducer onto top-hat rails or securing it with screws to a wall or panel
- Rated Burden Resistor up to 1 KΩ for 20 mA.

## Functional Block Diagram:



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## Applicable Standards:

| | | |
|---|---|---|
| EN 60688 | : | Electrical measuring transducers for converting AC electrical variables into analog and digital signals |
| IS 12784 | : | Electrical measuring transducers for converting ac Electrical Quantities into dc Electrical quantities - specification. |
| IEC 1010 or EN 61010 | : | Safety regulations for electrical measuring, control and laboratory equipment |
| IS 61000-4-2, 3, 4, 6 | : | Electromagnetic compatibility for industrial- process measurement and control equipment |
| DIN 40 110 | : | AC quantities |
| DIN 43 807 | : | Terminal markings |
| IS 9000 part 1 | : | Basic environmental testing procedures, vibration, sinusoidal |
| EN 55011 | : | Electromagnetic compatibility of data processing and telecommunication Equipment Limits and measuring principles for radio interference and information equipment |
| IS 14697 | : | AC static Transformer operated Watt-hour and VAR-Hour Meters (classes 0.5s) |

## Symbols\Abbreviations Used

| Symbols | Meaning |
|---|---|
| X | Measured variable |
| X0 | Lower limit of the measured variable |
| X1 | Break point of the measured variable |
| X2 | Upper limit of the measured variable |
| Y | Output variable |
| Y0 | Lower limit of the output variable |
| Y1 | Break point of the output variable |
| Y2 | Upper limit of the output variable |
| U | Input voltage |
| Ur | Rated value of the input voltage |
| U 12 | Phase-to-phase voltage L1 – L2 |
| U 23 | Phase-to-phase voltage L2 – L3 |
| U 31 | Phase-to-phase voltage L3 – L1 |
| U1N | Phase-to-neutral voltage L1 – N |
| U2N | Phase-to-neutral voltage L2 – N |
| U3N | Phase-to-neutral voltage L3 – N |
| UM | Average value of the voltages (U1N + U2N + U3N) / 3 |
| I | Input current |
| I1 | AC current L1 |
| I2 | AC current L2 |
| I3 | AC current L3 |
| Ir | Rated value of the input current |
| IM | Average value of the currents (I1 + I2 + I3) / 3 |
| IMS | Average value of the currents and sign of the active power (P) |
| Ø | Phase-shift between current and voltage |
| F | Frequency of the input variable |
| Fn | Rated frequency |
| P | Active power of the system P = P1 + P2 + P3 |
| P1 | Active power phase 1 (phase-to-neutral L1 – N) |
| P2 | Active power phase 2 (phase-to-neutral L2 – N) |
| P3 | Active power phase 3 (phase-to-neutral L3 – N) |
| Q | Reactive power of the system Q = Q1 + Q2 + Q3 |
| Q1 | Reactive power phase 1 (phase-to-neutral L1 – N) |
| Q2 | Reactive power phase 2 (phase-to-neutral L2 – N) |
| Q3 | Reactive power phase 3 (phase-to-neutral L3 – N) |
| S | Apparent power of the system S = $\sqrt{(I1^2+I2^2+I3^2)}+\sqrt{(V1^2+V2^2+V3^2)}$ |
| S1 | Apparent power phase 1 (phase-to-neutral L1 – N) |
| S2 | Apparent power phase 2 (phase-to-neutral L2 – N) |
| S3 | Apparent power phase 3 (phase-to-neutral L3 – N) |
| Sr | Rated value of the apparent power of the system |
| PF | Active power factor cosØ = P/S |
| PF1 | Active power factor phase 1 cosØ1 = P1/S1 |
| PF2 | Active power factor phase 2 cosØ2 = P2/S2 |
| PF3 | Active power factor phase 3 cosØ3 = P3/S3 |
| QF | Reactive power factor sin Ø = Q/S |
| QF1 | Reactive power factor phase 1 sin Ø1= Q1/S1 |
| QF2 | Reactive power factor phase 2 sin Ø 2= Q2/S2 |
| QF3 | Reactive power factor phase 3 sin Ø 3= Q3/S3 |
| LF | Power factor of the system LF = sgnQ · (1 – □PF□) |
| LF1 | Power factor phase 1 LF1 = sgnQ1 · (1 – \|PF1\|) |
| LF2 | Power factor phase 2LF2 = sgnQ2 · (1 – □PF2□) |
| LF3 | Power factor phase 3LF3 = sgnQ3 · (1 – □PF3□) |
| c | Factor for the intrinsic error |
| R | Output load |
| Rn | Rated burden |
| H | Power supply |
| Hn | Rated value of the power supply |
| CT | c.t. ratio |
| VT | v.t. ratio |

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## Technical data:

**Inputs**

Input variables:

U,U1N,U2N,U3N,U12,U23,U31,UM,
I,I1,I2,I3,IM,IMS,
P,P1,P2,P3,Q,Q1,Q2,Q3,S,S1,S2,S3,
PF,PF1,PF2,PF3,QF,QF1,QF2,QF3,LF,LF1,LF2,LF3

Measuring ranges

| Measurand | Initial Value | Final Value |
|---|---|---|
| U | 0 ≤ X0 ≤ 0.9* X2 | 0.8*Ur ≤ X2 ≤ 1.2* Ur |
| I | 0 ≤ X0 ≤ 0.8*X2 | 0.5*Ir ≤ X2 ≤ 1.5*Ir |
| P,Q,S | – X2 ≤ X0 ≤ 0.8 *X2 | 0.3 ≤ X2 / Sr ≤ 1.5 |
| PF,QF | – 1 ≤ X0 ≤ (X2 – 0.5) | 0 ≤ X2 ≤ 1 |
| F | 45Hz ≤ X0≤ (X2-2) | (X0+2) ≤ X2≤ 65Hz |

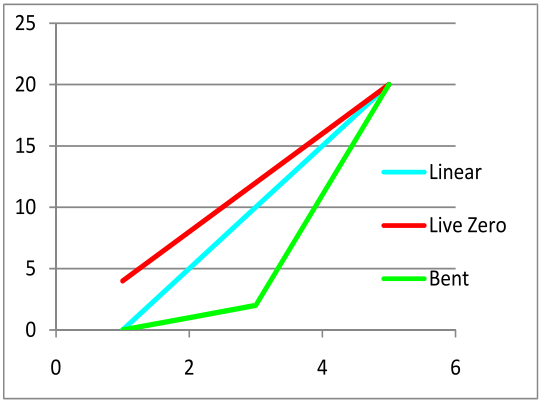
Waveform : Sinusoidal
Rated frequency : 50…60 Hz

**Continuous thermal ratings of inputs:**

Current circuit : 8 A
Voltage circuit : 480 V single-phase AC system
800 V three-phase system

**Short-time thermal rating of inputs**

| Input variable | Number of inputs | Duration Of overload | Interval between Two overloads |
|---|---|---|---|
| **Current circuit** | | | |
| 10 A | 10 | 10s | 10s. |
| 50 A | 5 | 3s | 5min. |
| **Voltage circuit** | | | |
| 1Ø AC system 600 V (L-N) | 10 | 10s | 10s |
| 3Ø AC system 1200 V (L-L) | 10 | 10s | 10s |

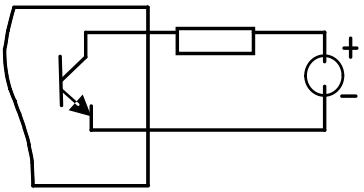



**Outputs:**

4 analog outputs following the corresponding process variable programmed through the software. These signals can be set in various patterns like Linear, live zero, bent. The outputs A, B, C and D may be either short or open-circuited. They are electrically insulated from each other and from all other circuits (floating). All the full-scale output values can be reduced subsequently using the programming software, subjective a supplementary error results. Conversion of a current to a voltage output or vice versa is also possible without any hardware change.

| Output signal | Initial value X0 | Final value X2 |
|---|---|---|
| DC current (Linear) (Live zero) | Y0 = 0<br>0 ≤ Y0 ≤ 0.2 * Y2 | Y2 = 20 mA<br>1 mA ≤ Y2 ≤ 20 mA |
| DC voltage | 0≤ Y0 ≤ 0.2 * Y2 | 1 V ≤ Y2 ≤ 10 V |
| Bent Characteristics (applicable to both Voltage and Current Output)<br>(X0 + 0.015 * X2) ≤ X1 ≤ 0.985 * X2 Y0 ≤ Y1 ≤ Y2 | | |

**Digital outputs, pulse outputs, limit outputs**




Type of contact : Open collector
Pulse duration : ≥ 80 ms
Interval : ≥ 80 ms
Power supply : 8 … 40 V
Output current : ON 10 … 27 mA
OFF ≤ 2 mA

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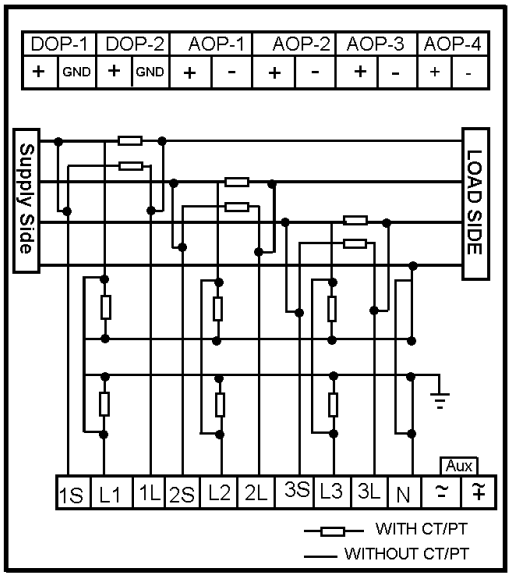
## Electrical connections

| Connection | Terminal No. | Connection | Terminal No. |
|---|---|---|---|
| $V_R$ | 2 | (ANALOG O/P)A+ | 13 |
| VY | 5 | (ANALOG O/P)A - | 14 |
| VB | 8 | (ANALOG O/P)B+ | 15 |
| N | 10 | (ANALOG O/P)B - | 16 |
| IR | 1 | (ANALOG O/P)C+ | 17 |
| IR' | 3 | (ANALOG O/P)C - | 18 |
| IY | 4 | (ANALOG O/P)D+ | 19 |
| IY' | 6 | (ANALOG O/P)D - | 20 |
| IB | 7 | (DIGITAL O/P)E+ | 21 |
| IB' | 9 | (DIGITAL O/P)E - | 22 |
| AUX | 11 | (DIGITAL O/P)F+ | 23 |
| AUX | 12 | (DIGITAL O/P)E - | 24 |

## Wiring Diagram




## Environmental

| | | |
|---|---|---|
| Working Temperature | : | 0 to +60°C |
| Storage | : | -10 to +70 deg c |
| Relative Humidity | : | 0 to 95% non condensing |
| Vibration | : | +/- 1g, 10 to 150Hz |

## Safety

| | | |
|---|---|---|
| Protection Class | : | Class II |
| IP Rating | : | IP20 |
| Over Voltage Cat | : | Cat III |
| Surge Test | : | 6KV, 12/50us, 5WS |
| HV Test | : | I/p to O/p isolation 2 kV (4 kV optional)<br>o/p to o/p isolation 500V (2 kV optional)<br>Communication Interface<br>(USB / RS485) to all circuit 2KV |

## MODBUS

| | | |
|---|---|---|
| BUS Interface | : | RS485 |
| Terminal | : | RJ11 socket over Top |
| Max. Distance | : | 1200Mtr. |
| No. Of Bus Stations | : | Upto 248 including Master. |
| Dummy load | : | Not required |

## USB Connector :

USB Female B-Type Connector.
Software CD containing Driver and Windows based Software for Configuration of PMT-9 is also supplied along with the Box Pack.