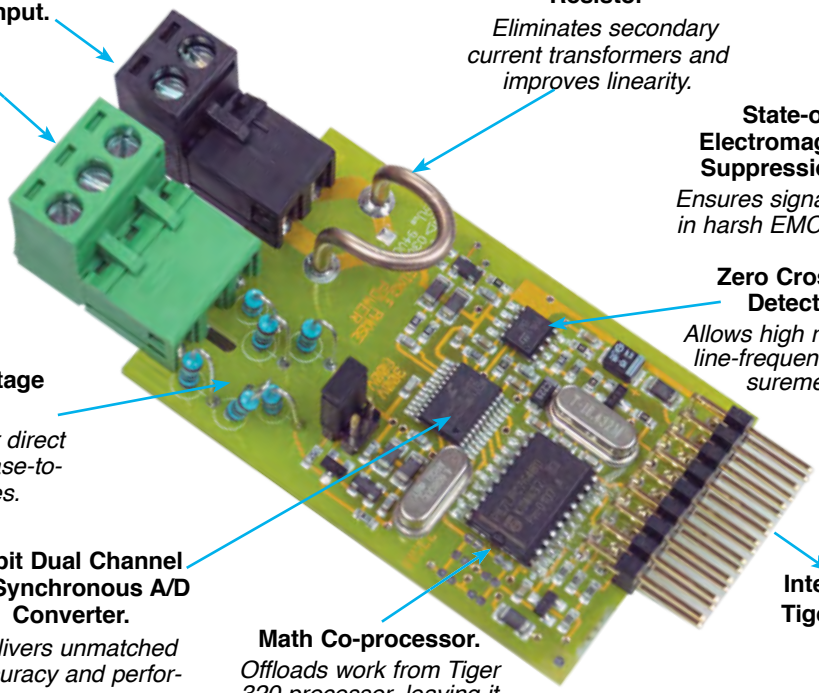
TEXMATE INC

SMART INPUT MODULE

SINGLE PHASE POWER



The complete solution to stand-alone low cost metering applications required in the power industry.

When combined with the powerful Tiger 320 Series controller, this module performs many common AC functions including:

- Power for single-phase 2-wire and single-phase 3-wire systems.
- R.M.S. voltage for both line-to-line and line-to-neutral systems.
- R.M.S. current via 1 amp or 5 amp CTs. Power factor (Cos ø).

The Tiger 320 Series controller can convert kW to kW hrs and amps to amp hrs using its dual totalizers and resolve the zero crossing detector line-frequency to 3 decimal places.

INPUT MODULE ORDER CODE

IW04 (600V, 1 Amp)

IW05 (600V, 5 Amp)

Hardware Module Specifications	
Voltage Range	50-600 VAC
Current Range	Either 1 amp or 5 amp current transformers.
Voltage Accuracy	0.1% of full scale input.
Current Accuracy	0.05% of full scale input.
Power Accuracy	± 0.2% of full scale input.
Cos ø Accuracy	± 0.5% of full scale output ± 0.3°.
Temperature Drift	60 ppm/ °C maximum.
Output Signal Rate	5 Hz.
Frequency Resolution	± 0.001 Hz

Software Module Features	
Current Gain	Selectable between 1.0 for typical systems, and 0.2 for systems with large crest factors.
Factory Calibrated	User need only scale results, no AC calibrator required.

Some Relevant Tiger 320 Series Operating System Features
Setpoint timer functions.
Setpoint register reset and trigger functions.
Totalizers.
Analog outputs.
Direct display of selected outputs.

Fits Tiger 320 Series

SINGLE PHASE POWER

INPUTS

Power Factor
kVA
kVAR
kWH

Volts AC

Amps AC

Watts AC
Watt hours

Frequency
Mains

Connector Pinouts

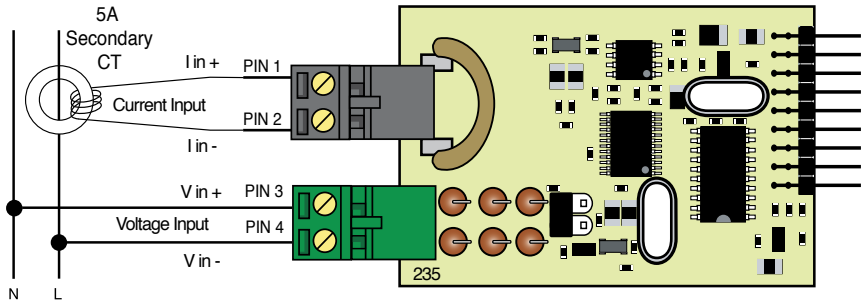


Figure 1 – Single Phase, 2-wire Configuration

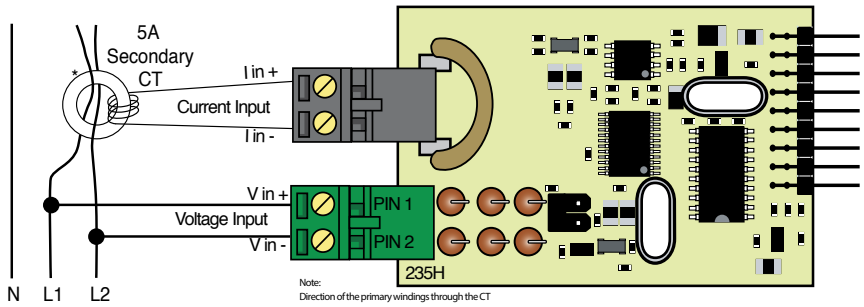


Figure 2 – Single Phase, 3-wire Configuration

Smart Setup Registers

The meter uses three smart setup registers to configure all smart input modules. Input modules IW04/5 require only smart register 1 to be set up. These modules produce four output registers.

One of these registers can be transferred to Channel 1 via Code 2, the same or another register to Channel 2 via Code 4, the same or another register to Channel 3 via Code 5, and the same or another register to Channel 4 via Code 6.

Input modules IW01/2/4/5 have a zero crossing detector that is available for direct line-frequency measurement in Channel 2. The following resolution settings can be selected in Code 4:

- 0 to 99.999 Hz, 0.001 Hz resolution.

  Set Code 4 to [30X].
- 0 to 999.99 Hz, 0.01 Hz resolution.

  Set Code 4 to [31X].

Note, the direct line-frequency measurement setting for channel 2 is a hard-wired option and, if selected, means channel 2 is not available for selecting an output register.

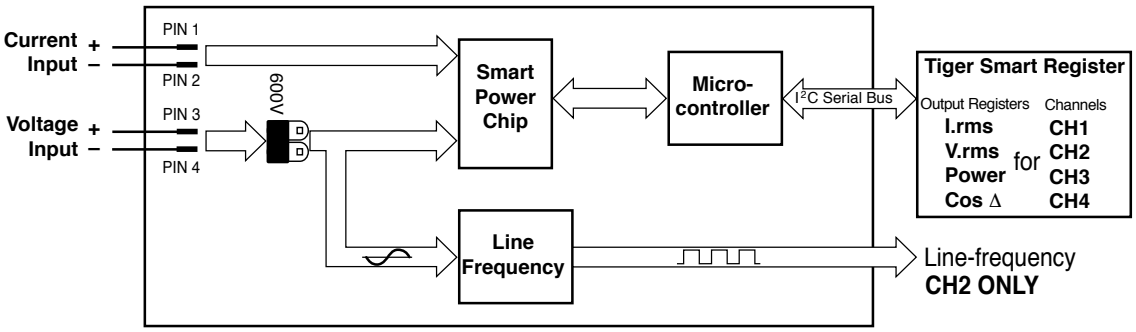


Figure 3 – Smart Input Module IW04/5 Signal Flow Diagram

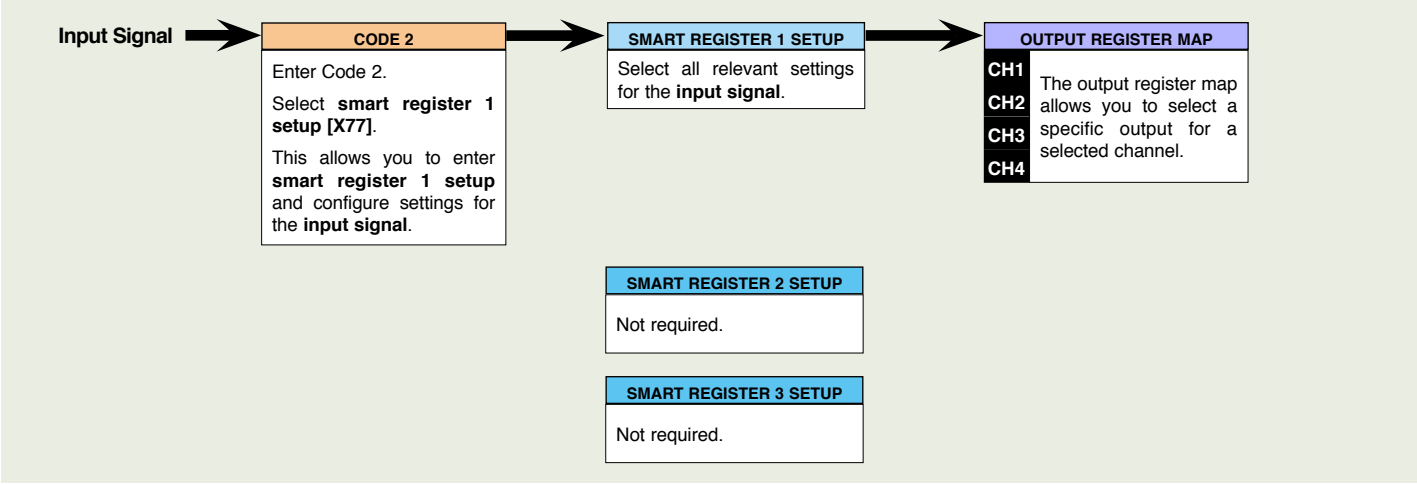


Figure 4 – IW04/5 Smart Setup Registers – Operational Flow Diagram

Programming Procedures

The following programming procedures cover all the steps required to configure smart input module IW04/05 as follows:

- Channel 1 to display current (I rms).
- Channel 2 to display direct line-frequency measurement.
- Channel 3 to display voltage (V rms).
- Channel 4 to display power usage (kW).

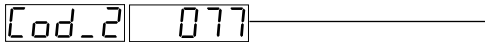
Steps **1** to **6** describe how to select the **current gain** setting through smart register 1.

Steps **7** to **13** describe how to select the output registers for channels 1, 2, 3, or 4 as required.

Steps **14** to **16** describe how to select line-frequency for channel 2.

1 Press the P and ⬆ buttons at the same time to enter the main programming mode.

2 Press the P button three times to enter Code 2. Set Code 2 to [077].



This setting enters the **smart register 1** code setup menu.

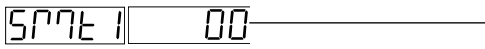
FIRST DIGIT
Must be 0

SECOND DIGIT	
MEASUREMENT TASK	
0	**Voltage, Current**
1	TC (3rd digit selects type of TC)
2	RTD 3-wire (3rd digit selects type of RTD)
3	RTD 2- or 4-wire (3rd digit selects type of RTD)
4	Frequency
5	Period
6	Counter
7	Smart Input Module

THIRD DIGIT	
OUTPUT REGISTER MAP	
0	**I.rms**
1	V.rms
2	Power
3	Cos ∅
4	-
5	-
6	-
7	Smart input module **register 1** code setup

Note the output register map is different for each smart input module.

3 Press the P button.



FIRST DIGIT
Not relevant

SECOND DIGIT
Not relevant

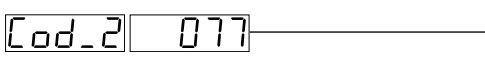
THIRD DIGIT	
CURRENT GAIN	
0	**1**
1	0.2
2	-
3	-
4	-
5	-
6	-
7	-

4 Using the ⬆⬇ buttons, select the relevant **current gain** settings.

This menu provides settings unique to input modules IW01 to IW04.

5 Press the P button.

This takes you back to the Code 2 menu.



Note the output registers in the 3rd digit are specific to IW04/5. These registers vary for each different smart input module.

6 The next step is to select the appropriate output register from the output register map for a selected channel.

Continued on next page

Select a Channel

Select the output register for the required channels

7 Press the [P] and [↑] button at the same time again to re-enter the main programming mode.

8 Press the [P] button three times to enter Code 2.

9 To select **channel 1**, set Code 2 to [X7X]. Select the required processing rate for **CH1** in the 1st digit and the required register map settings in the 3rd digit.

CH1 Cod_2 X7X →

FIRST DIGIT
TIGER PROCESSING RATE
0 10 Hz
1 10 Hz
2 100 Hz
3 100Hz

SECOND DIGIT
MEASUREMENT TASK
0 Voltage, Current
1 TC (3rd digit selects type of TC)
2 RTD 3-wire (3rd digit selects type of RTD)
3 RTD 2- or 4-wire (3rd digit selects type of RTD)
4 Frequency
5 Period
6 Counter
7 Smart Input Module

THIRD DIGIT
OUTPUT REGISTER MAP
0 I.rms
1 V.rms
2 Power
3 Cos ∅
4 -
5 -
6 -
7 Smart input module **register 1** code setup

Note the output register map is different for each smart input module type.

10 To select **channel 2**, enter Code 4 and select the required register map settings for **CH2** in the 2nd digit.

CH2 Cod_4 0X0 →

Note, If you require the **direct line-frequency measurement** setting, channel 2 will not available for selecting an output register.

FIRST DIGIT
MEASUREMENT TASK
Voltage, Current
1 TC (type as per 2nd digit)
2 RTD (type as per 2nd digit)
3 Second Digital Input Channel (type as per 2nd digit)

SECOND DIGIT
FOR VOLTAGE & CURRENT
0 Channel 2 Disabled
1 Direct (no post processing)
2 Square Root of Channel 2
3 Inverse of Channel 2
4 Output Register 1 (smart module)*
5 Output Register 2 (smart module)*
6 Output Register 3 (smart module)*
7 Output Register 4 (smart module)*

**Note:*
The logic for CH2 is not the same as CH1, CH3, or CH4. The 1st and 3rd digits must both be set to 0. Selecting 040 to 070 in the 2nd digit of Code 4 directly selects one of the following settings in the smart register 1 map (3rd digit):

2nd Digit	Output Register Map
4 selects	**0 I.rms**
5 selects	1 V.rms
6 selects	2 Power
7 selects	3 Cos ∅

11 To select **channel 3**, enter Code 5 and select the required post processing settings for **CH3** in the 1st digit and the required register map settings in the 3rd digit.

Cod_5 X7X →

FIRST DIGIT
CH3 POST PROCESSING
0 Direct Display of Input (no processing)
1 Square Root of Channel 3
2 Inverse of Channel 3
3 **Meters with 4 kB memory** NO Linearization **Meters with 32 kB memory** 32-point Linearization of CH3 using Table 3
Note: All linearization tables are set up in the Calibration Mode [24X].

THIRD DIGIT
OUTPUT REGISTER MAP
0 I.rms
1 V.rms
2 Power
3 Cos ∅
4 -
5 -
6 -
7 Smart input module **register 1** code setup

Note the output register map is different for each smart input module type.

12 To select **channel 4**, enter Code 6 and select the required post processing settings for **CH4** in the 1st digit and the required register map settings in the 3rd digit.

CH4 Cod_6 X7X →

FIRST DIGIT
CH4 POST PROCESSING
0 Direct Display of Input (no processing)
1 Square Root of Channel 4
2 Inverse of Channel 4
3 **Meters with 4 kB memory** NO Linearization **Meters with 32 kB memory** 32-point Linearization of CH4 using Table 4
Note: All linearization tables are set up in the Calibration Mode [24X].

Press the [P] button to save the settings.

13 Press the [P] and [↑] buttons at the same time to return to the operational display.

Select the Line Frequency

Select the line frequency on Channel 2

Note, the direct line-frequency measurement setting for channel 2 is a hard-wired option and, if selected, means channel 2 is not available for selecting an output register.

14 Press the P and ⇧ button at the same time again to re-enter the main programming mode.

15 Press the P button five times to enter Code 4.

16 Set Code 4 to [3X0]. Select the required line frequency measurement in the 2nd digit.

CH2 Cod_4 0X0 →

FIRST DIGIT
MEASUREMENT TASK
0 Voltage, Current
1 TC (type as per 2nd digit)
2 RTD (type as per 2nd digit)
3 Second Digital Input Channel (type as per 2nd digit)

SECOND DIGIT
DIGITAL INPUT
0 Frequency - 99.999 Hz range from 0.001 Hz
1 Frequency - 999.99 Hz range from 0.01 Hz

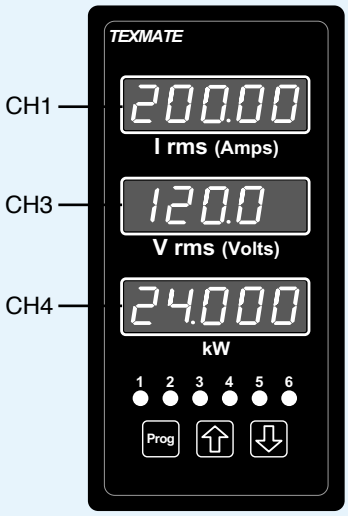
THIRD DIGIT
OUTPUT REGISTER MAP
0 I.rms
1 V.rms
2 Power
3 Cos ∅
4 -
5 -
6 -
7 Smart input module **register 1** code setup

Example Single Phase Power Module Setup Procedure

Our customer has a powerful single phase motor connected to the 120 V rms supply. The motor can draw up to 200 A rms under full load. As part of the supervisory programme, the owner requires to monitor the line voltage, current draw, and resultant power usage simultaneously.

A Tiger 320 Series triple display meter is installed to display:

- Channel 1: Current (I rms) on the top (primary display).
- Channel 3: Voltage (V rms) on the middle display.
- Channel 4: Power usage (kW) on the bottom display.
- Channel 2: Configured to read the line frequency at 0.01 Hz resolution (displayable in the view mode).



Because there is a 5 A rms maximum current limit on smart power module IW02, a 200:5 current transformer is used to sense the load current.

The meter is calibrated at the factory to the following default settings with a scale factor of 1 and an offset of 0:

- 30,000 counts for 5 A rms.
- 1000 counts for 100 V rms.
- 10,000 counts for 500 W.

To accomodate the customer's specifications, the offsets remain at 0, but the scale factors must be adjusted to display (See **Recalibration Procedures** on Page 6):

- 20,000 counts for 200 A on CH1.
- 1,200 counts for 120 V on CH3.
- 24,000 counts for 24 kW on CH4.

The new scale factors are calculated as follows:

1 CH1 Scale Factor

Our **200 A** load is reduced to **5 A** to suit the smart input module's maximum current limit by passing it through a 200:5 current transformer (CT).

The original factory setting was **30,000** counts for the maximum load.

We now want to display **20,000** counts for the same load. Therefore, the scale factor is calulated as:

$$\text{CH1 Scale Factor} = \frac{20{,}000}{30{,}000} = \mathbf{0.666}\ \text{(I rms)}$$

2 CH3 Scale Factor

Our original factory setting for the **100 V** line voltage was **1,000** counts. Applying a new line voltage of **120 V** to the original settings for CH3 displays **1,200** counts on the meter. Therefore, no adjustment is necessary and the scale factor remains unchanged at **1.0**.

3 CH4 Scale Factor

Our original factory setting for the power reading on CH4 is:

5 A load & 100 V line voltage = 500 W over 10,000 counts

Our load has now increased to 200 A, which is passed through a 200:5 CT effectively retaining a 5 A load. Our line voltage has increased to 120 V displayed over 1,200 counts. This means we now have:

5 A load (actual 200 A) & 120 V line voltage = 600 W over 12,000 counts

We wish to double the resolution of the power reading on the display to 24,000 counts for the maximum load. Therefore, the scale factor is calculated as:

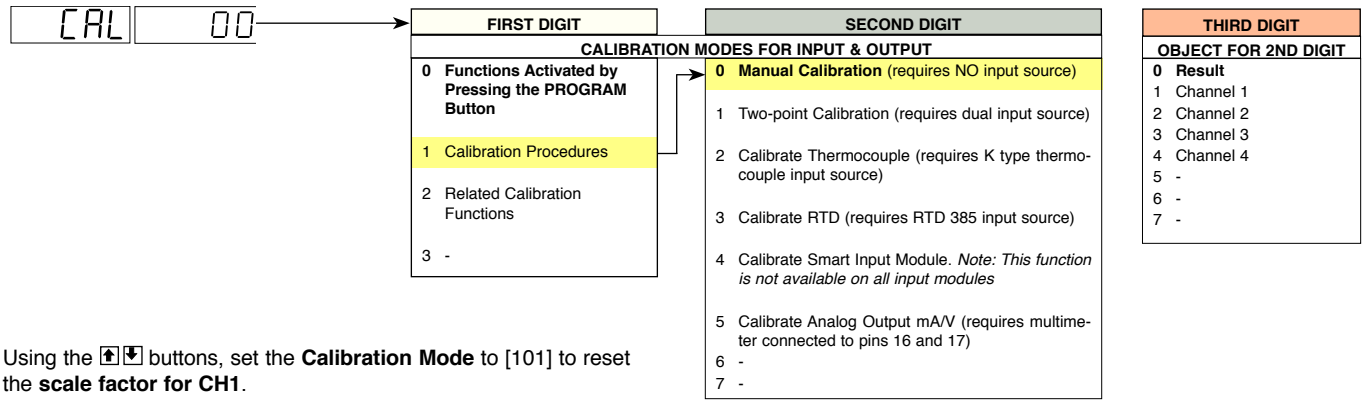
$$\text{CH4 Scale Factor} = \frac{24{,}000}{12{,}000} = \mathbf{2.0}$$

Recalibration Procedures

The following recalibration procedures describe how to recalibrate the scale factors for CH1, CH3, and CH4 if they are different from the Texmate factory default settings. See the new scale factor calculations on the example on Page 5.

1 Press the [P] and ↑ buttons at the same time to enter the main programming mode.

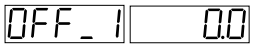
2 Press the [P] button once to enter the calibration mode.



3 Using the ↑↓ buttons, set the **Calibration Mode** to [101] to reset the **scale factor for CH1**.

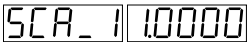
The display toggles between [CAL] and [101]. 

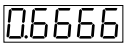
4 Press the [P] button.

The display toggles between [OFF_1] and [0.0]. 

The COS ∅ value does not require any user scaling. However, make sure that the appropriate channel scaling register is set to 1.0 and the offset set to 0.

5 Press the [P] button.

The display toggles between [SCA_1] and [1.0000]. 

6 Using the ↑↓ buttons, reset the **Scale Factor** for **CH1** to the new settings. 

Example

7 Press the [P] button once to return to the calibration mode.

The display toggles between [CAL] and [101]. 

8 Using the ↑↓ buttons, set the **Calibration Mode** to [103].

The display enters the offset and scale factor setting menu for **CH3**. 

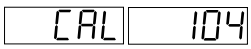
9 Repeat Steps 4 to 6, but set the **Scale Factor** for **CH3** to the new settings. 

Example

10 Press the [P] button once to return to the calibration mode.

The display toggles between [CAL] and [103]. 

11 Using the ↑↓ buttons, set the **Calibration Mode** to [104].

The display enters the offset and scale factor setting menu for **CH4**. 

12 Repeat Steps 4 to 6, but set the **Scale Factor** for **CH4** to the new settings. 

Example

13 Press the [P] button to save the settings.

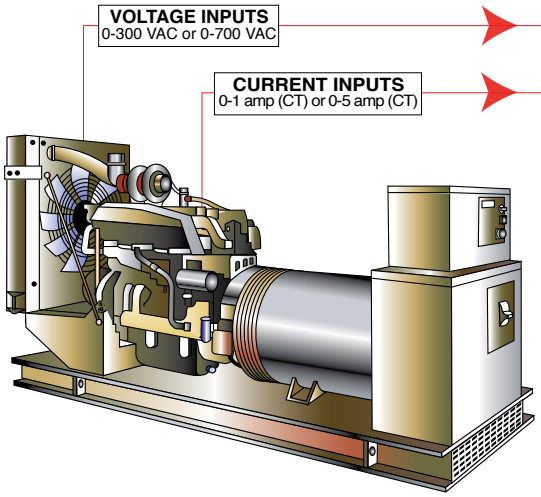
14 Press the [P] and ↑ buttons at the same time to return to the operational display.

The scale factor for CH1, CH3, and CH4 has now been reset.

It is no longer necessary to use combinations of transducers to achieve a power measurement and control system.
A Texmate Tiger 320 Series DI-503 meter, installed with a single-phase power input module, calculates and displays volts, amps, Hz, watts, watt hours, and power factor from a single-phase 2 or 3-wire voltage and current input.

The optional relay, analog and serial outputs can be configured from all the above parameters to interface with a control or alarm system.

SINGLE PHASE MEASUREMENT AND CONTROL

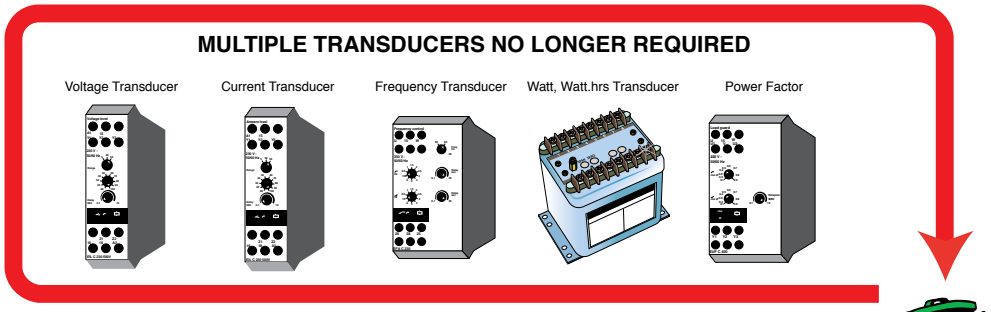


OPTIONS

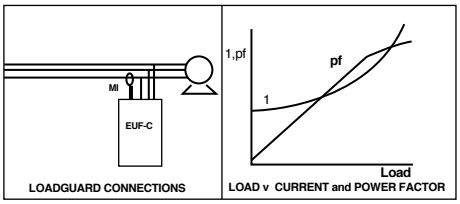
- Up to 6 super smart relay outputs, digitally programmable upper and lower limits.
- Programmable deviation mode, hysteresis mode, latch ON or latch OFF.
- Built-in super smart timers on each setpoint.
- Programmable DOM to eliminate nuisance tripping.
- Power ON inhibit to avoid tripping during power up.
- Dual 4-20 mA or 0-10 V, 16-bit analog output.
- RS-232 or RS-485.
- DeviceNet / ModBus.
- Direct serial printer output.
- Data logging with real-time clock.

DISPLAY AND CALCULATE

Voltage (R.M.S.).
Current (R.M.S.).
Frequency.
Watts, kilowatts.
Watt hours, kilowatt hours.
Power factor monitoring
for precise load sensing.*



* APPLICATION CONCEPT



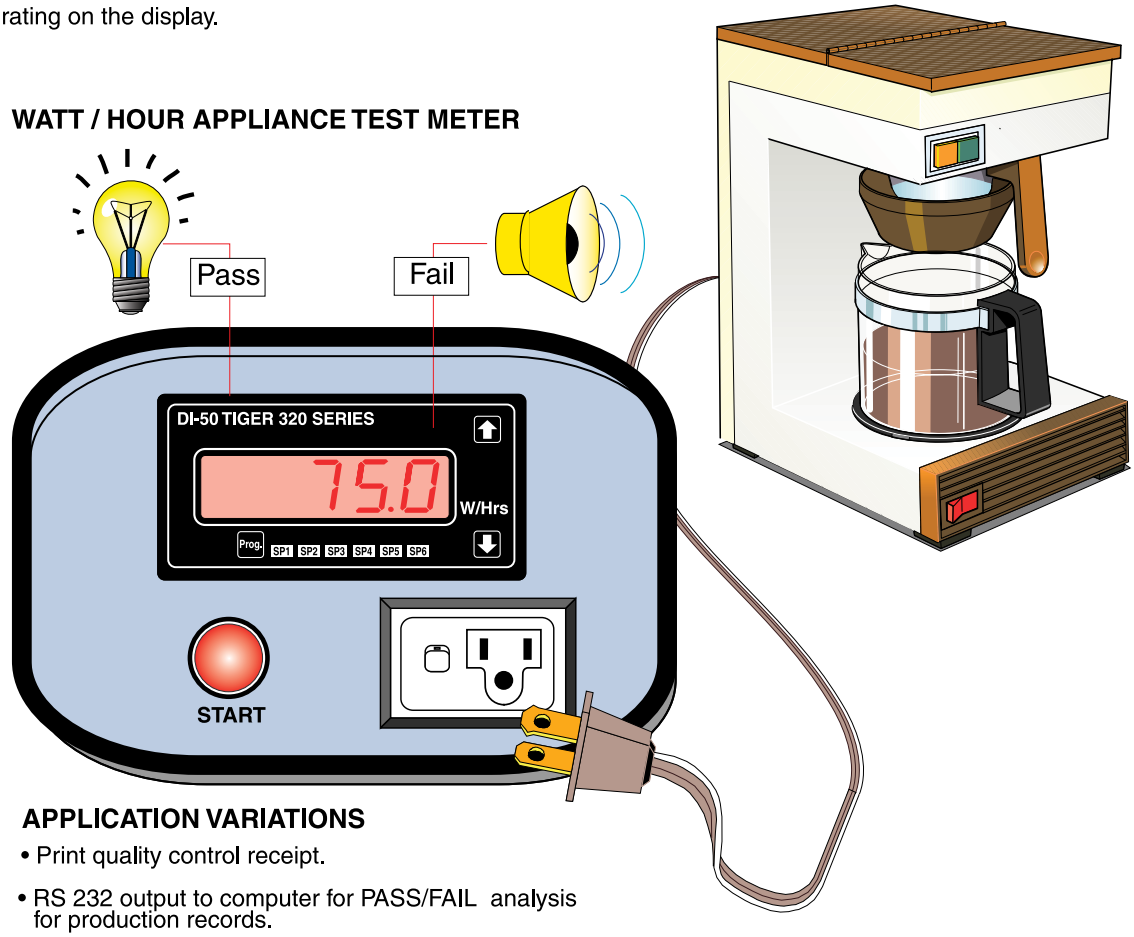
Power factor gives an accurate measure of load change, particularly at low to medium loads, where current is dominated by it's magnetizing element. Where prompt action is required the optional relays in the Tiger 320 Series meter can be used for protection against broken belts, pump cavitation, conveyor stalling and general overloads.

20 Watt / Hour Appliance Test Meter.

Our customer requires a quality control test for watt/hour rating of electrical appliances. The test is carried out over 5 minutes. Texmate installed a DI-50E controller with a watt input module. When the start button is pressed, the controller is programmed to totalize the watt/hours for 5 minutes and hold the watt/hour rating on the display.

When the next appliance is connected and the start button is pressed, the meter resets to 0 and counts the watts for 5 minutes again. A setpoint is programmed in the deviation mode to indicate PASS/FAIL. The appliance ON-time is programmable to suit any application.

WATT / HOUR APPLIANCE TEST METER



APPLICATION VARIATIONS

- Print quality control receipt.
- RS 232 output to computer for PASS/FAIL analysis for production records.
- For current applications above 5 A, a current transformer is required.

WARRANTY

Texmate warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment. Texmate's obligations under this warranty are limited to replacement or repair, at its option, at its factory, of any of the products which shall, within the applicable period after shipment, be returned to Texmate's facility, transportation charges pre-paid, and which are, after examination, disclosed to the satisfaction of Texmate to be thus defective. The warranty shall not apply to any equipment which shall have been repaired or altered, except by Texmate, or which shall have been subjected to misuse, negligence, or accident. In no case shall Texmate's liability exceed the original purchase price. The aforementioned provisions do not extend the original warranty period of any product which has been either repaired or replaced by Texmate.

USER'S RESPONSIBILITY

We are pleased to offer suggestions on the use of our various products either by way of printed matter or through direct contact with our sales/application engineering staff. However, since we have no control over the use of our products once they are shipped, NO WARRANTY WHETHER OF MERCHANTABILITY, FITNESS FOR PURPOSE, OR OTHERWISE is made beyond the repair, replacement, or refund of purchase price at the sole discretion of Texmate. Users shall determine the suitability of the proDXct for the intended application before using, and the users assume all risk and liability whatsoever in connection therewith, regardless of any of our suggestions or statements as to application or construction. In no event shall Texmate's liability, in law or otherwise, be in excess of the purchase price of the product.

Texmate cannot assume responsibility for any circuitry described. No circuit patent or software licenses are implied. Texmate reserves the right to change circuitry, operating software, specifications, and prices without notice at any time.

TEXMATE Since 1976
Smart Measuring Smart Control MADE IN U.S.A.
1934 Kellogg Ave., Carlsbad, CA 92008
Tel: 1-760-598-9899 • USA 1-800-839-6283 • 1-800-TEXMATE
Fax: 1-760-598-9828 • Email: orders@texmate.com • Web: www.texmate.com