TCM-94N-1
TCM-94N-2

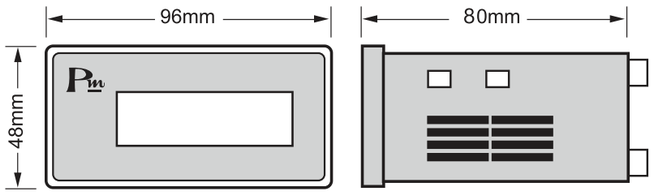
DIGITAL AC AMP METER (TRUE RMS)
DIGITAL DC AMP METER

Primus
User Manual

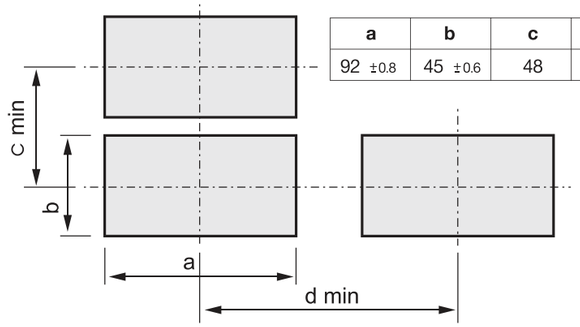
TECHNICAL SPECIFICATION

Model		TCM-94N-1	TCM-94N-2
Power Supply		100 - 250 VAC 50/60 Hz	
		24 VAC/VDC ±15%	
Power consumption		3 VA	
Display		7-Segment, Size 0.56 Inch, 5 Digit	
		3 LED (Show Alarm Relay)	
		1 LED (Show Communication)	
		1 LED (Show Peak)	
Input	Current	AC Current	DC Current
		0 - 5 Amp (Direct)	0-75 mV
		0 - 20000 Amp (With CT)	0-150 mV(With RShunt)
	Accuracy	± 0.25 % of Measurement Range at 25 ˚C	
Output	Relay Alarm	3 Alarm 5A 250VAC	
	Tranfer Current	4 - 20 mA	
	Tranfer Voltage	0 - 10 VDC	
	Output Impedance	Load 500 Ω for 4 - 20 mA Output Load 1 kΩ for 0 - 10 VDC Output	
	Accuracy	± 0.25 % of Output Range	
Communication	Protocol	Modbus RTU	
	Address	1 - 127	
	Baud Rate	2400, 4800, 9600,19200, 38400, 57600 bps	
	Parity	None, even, odd	
	Data Bit	8 bit	
	Stop Bit	1, 2	
	Support Device Node	32	
Ambient operation	Temperature	-10 ˚C to 60 ˚C	
	Humidity	85 % RH Non-Condesing	
Ambient storage	Temperature	-20 ˚C to 80 ˚C	
	Humidity	85 % RH Non-Condesing	
Protection Degree	Front Protection Rating	IP52	
	Case Protection Rating	IP30	
Installation		Panel, Mounting	
Material		ABS-V0	
Size		48x96x80 mm.	
Weight		240 g.	

DIMENSION

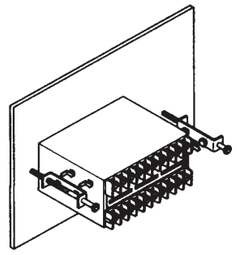


CUTTING PANEL



a	b	c	d
92 ±0.8	45 ±0.6	48	120

INSTALLATION



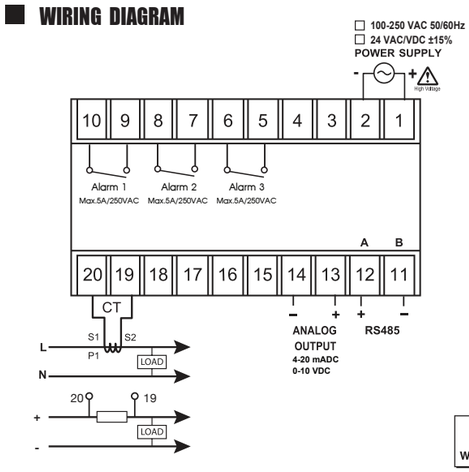
DESCRIPTION

- TCM-94N-1 measure AC electrical signal range 0-5 A frequency 50/60 Hz.
- TCM-94N-2 measure DC electrical signal range 0-75 mV and 0-150 mV from R-Shunt.
- 7-Segment display 5 digits size 0.56 inch.
- 3 Alarm relay output with 4 functions in setting.
- Can communicate with computer via RS-485 (Modbus RTU protocol)
- Transfer output 4-20mA and 0-10 Vdc for connect with other devices.
- Lock function to protect the value is changed by setting from screen.
- ON-OFF delay time for Alarm output.
- Manual Transfer output Function can supply signal volume as require.
- Absolute Input Function always show positive value although connect terminal +/- switch the terminals or not for TCM-94N-2.

GENERAL DESCRIPTION

TCM-94N is measure and display current value DC and AC by AC system can connect with CT measure range 0-20,000 VAC and can connect directly range 0.5 A and DC system can connect with Shunt Resistor which has 2 range to choose are 0-75 mVDC and 0-150 mVDC by setting from CT Ratio multiplier and Shunt Resistor. It can collect and save data to computer via communication port RS-485 Modbus RTU and can connect analog Transfer output signal with other device and there are 3 Alarm output by 4 Alarm function for setting to cut or connect Load as require.

WIRING DIAGRAM



Front keypad and LED status screen display

- AL1 ● Show operation of Alarm 1.
- AL2 ● Show operation of Alarm 2.
- AL3 ● Show operation of Alarm 3.
- COM ● Show communication status.
- PEAK ● Show maximum peak.

- F Press for enter program.
- ▲ Press for increase value or choose program value.
- ▼ Press for decrease value or choose program value.

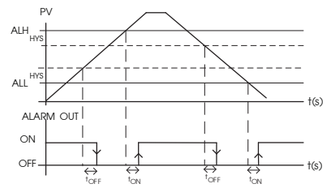
WARNING

- Make sure the correct wiring connection before turning on electricity. Mis-wiring may cause malfunction of the unit and fire.
- Never modify the unit to prevent damage or incident such as malfunction and fire etc.

ALARM OUTPUT : Process value (PV) to be used as Alarm Output.

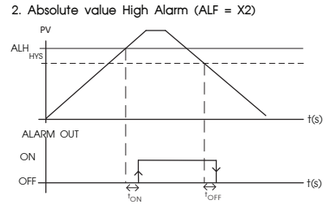
Stand-by Sequence : After Starting Operation of Step, Alarm Output Does not Turn On Unless The Process Value Reach the Value of OFF Position of Alarm Output.

1. Absolute value High Low Band Alarm (ALF = X1)



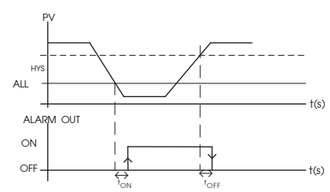
$ALARM\ ON = \begin{cases} PV \le ALL \\ PV \ge ALH \end{cases}$ $ALARM\ OFF = \begin{cases} PV > ALL + HYS \\ PV < ALH - HYS \end{cases}$

2. Absolute value High Alarm (ALF = X2)



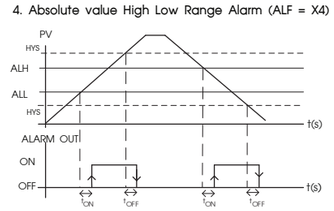
$ALARM\ ON = PV \ge ALH$ $ALARM\ OFF = PV < ALH - HYS$

3. Absolute value Low Alarm (ALF = X3)



$ALARM\ ON = PV \le ALL$ $ALARM\ OFF = PV > ALL + HYS$

4. Absolute value High Low Range Alarm (ALF = X4)



$ALARM\ ON = \begin{cases} PV \ge ALL \\ PV \le ALH \end{cases}$ $ALARM\ OFF = \begin{cases} PV < ALL - HYS \\ PV > ALH + HYS \end{cases}$

ORDERING CODE

TCM-94N- [INPUT] - A [ALARM OUTPUT] [ALARM OUTPUT] - [TRANSFER OUTPUT] - [MODBUS PROTOCOL] - [POWER SUPPLY]

INPUT	
1	AC Current
2	DC Current

ALARM OUTPUT	
B	Alarm 2
C	Alarm 3

TRANSFER OUTPUT	
G	Transfer 0-10 VDC
I	Transfer 4-20 mA

MODBUS PROTOCOL	
M	RS-485

POWER SUPPLY	
220	100-250 VAC 50/60Hz
24	24 VAC/VDC ±15%

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OPERATION SETTING

- Power On → Bink Display for start
- Show Version → Show last Version
- Show Model → Show Model
- Operation Mode Display → Show Current Value

Press [F] Key More Than 2 Seconds

[F] for Setting

(Alarm 1 Function > 0) / (Alarm 1 Function = 0) >>

- High limit Setting For Alarm 1 — Set high limit value for alarm 1. (ALL1 - 30000)
- Low limit Setting For Alarm 1 — Set Low limit value for alarm 1. (0 - ALH1)
- Hysteresis Setting For Alarm 1 — Set hysteresis when required (0 to ALH-ALL)
- Delay Time On Alarm 1 — Set delay time (Alarm on) when required. (0 - 60s)
- Delay Time Off Alarm 1 — Set delay time (Alarm off) when required. (0 - 60s)

[F] Key

(Alarm 2 Function > 0) / (Alarm 2 Function = 0) >>

- High limit Setting For Alarm 2 — Set high limit value for alarm 2. (ALL2 - 30000)
- Low limit Setting For Alarm 2 — Set Low limit value for alarm 2. (0 - ALH2)
- Hysteresis Setting For Alarm 2 — Set hysteresis when required (0 to ALH-ALL)
- Delay Time On Alarm 2 — Set delay time (Alarm on) when required. (0 - 60s)
- Delay Time Off Alarm 2 — Set delay time (Alarm off) when required. (0 - 60s)

[F] Key

(Alarm 3 Function > 0) / (Alarm 3 Function = 0) >>

- High limit Setting For Alarm 2 — Set high limit value for alarm 3. (ALL3 - 30000)
- Low limit Setting For Alarm 2 — Set Low limit value for alarm 3. (0 - ALH3)
- Hysteresis Setting For Alarm 3 — Set hysteresis when required (0 to ALH-ALL)
- Delay Time On Alarm 3 — Set delay time (Alarm on) when required. (0 - 60s)
- Delay Time Off Alarm 3 — Set delay time (Alarm off) when required. (0 - 60s)

- Operation Mode Display — 500 แสดงค่ากระแสที่วัดได้

[C] for Setting

(Alarm 1 Function > 0) / (Alarm 1 Function = 0) >>

- High limit Setting For Alarm 1 — Set high limit value for alarm 1. (Limit follow SLH and SLL)

Show PV High & PV Low

- Operation Mode Display — 500 แสดงค่ากระแสที่วัดได้

[C] Key

- High limit Setting For Alarm 1 — Set high limit value for alarm 1. (Limit follow SLH and SLL)

Press [▼] Key More Than 5 Seconds

- Delay Time On Alarm 2 — Set delay time (Alarm on) when required. (0 - 60s)

[C] Key Operation Mode Display

Select Range Input mV (for TCM-94N-2 only)

inP — 0
- 0 : 0-75 mV
- 1 : 0-150 mV

[F]Next [C]Back

Multiplier Setting

MUL — 1 — Set Multiplier 1-4000

[F]Next [C]Back

Divisor Setting

diu — 1.0 — Set Divisor 0.1-100.0

[F]Next [C]Back

PV Correction

PuS — 1 — When measurement value error. Set the correction value (-1999 - 1999)

[F]Next [C]Back

PV Filter

PuF — 0 — Filter effects operation on software to process value (0 - 15)

[F]Next [C]Back

Decimal Point Selection

dP — 0.0
- 0 : None required
- 0.0 : 1 Digit

[F]Next [C]Back

Key Lock Setting

LoC — 0 — Set Lock parameter
- 0 : None
- 1 : All Lock
- 2 : Operation mode lock only
- 3 : Except operation mode

[F]Next [C]Back

Analog Absolute Display Setting

dAbS — 0 — Set 1 for display absolute value

[F]Next [C]Back

High Limit Setting In Analog Input Limiter

inH — 0 — Sets scalling high limit value

[F]Next [C]Back

Analog Absolute Display Setting

inL — 0 — Sets scalling low limit value

[F]Next [C]Back

High Limit Setting

SLH — 0 — Sets scalling high limit value for setting (0-30000)

[F]Next [C]Back

Low Limit Setting

SLL — 0 — Sets scalling Low limit value for setting (0-30000)

[F]Next [C]Back

Transfer Output Polarity

trP — 0 — Set 1 for Inverse Transfer Output Value.

[F]Next [C]Back

High Limit Setting for Transfer Output

trH — 0 — Set scaling high limit value for transfer output. (Limit follow SLH and SLL)

[F]Next [C]Back

Low Limit Setting for Transfer Output

trL — 0 — Set scaling Low limit value for transfer output. (Limit follow SLH and SLL)

[F]Next [C]Back

Function Setting for Alarm 1

ALF1 — 0 — Select below functions.1

00

PV Alarm Functions
- 0 : None
- 1 : Absolute Value High Low Band Alarm
- 2 : Absolute Value High Alarm
- 3 : Absolute Value Low Alarm
- 4 : Absolute Value High Low Range Alarm

Additional Alarm Function
- 0 : None
- 1 : Alarm Output Hold
- 2 : Stand-by Sequence
- 3 : Stand-by Sequence & Hold

[F]Next [C]Back

(Alarm 1 Function > 0) / (Alarm 1 Function = 0) >>

High limit Setting For Alarm 1

ALH1 — 0 — Set high limit value for alarm 1. (ALL1 - 30000)

[F]Next [C]Back

Low limit Setting For Alarm 1

ALL1 — 0 — Set Low limit value for alarm 1. (0 - ALH1)

[F]Next [C]Back

Hysteresis Setting For Alarm 1

HYS1 — 0 — Set hysteresis when required (0 to ALH-ALL)

[F]Next [C]Back

Delay Time On Alarm 1

ton1 — 0 — Set delay time (Alarm on) when required. (0 - 60s)

[F]Next [C]Back

Delay Time Off Alarm 1

toFF1 — 0 — Set delay time (Alarm off) when required. (0 - 60s)

[F]Next [C]Back

Function Setting for Alarm 2

ALF2 — 0 — Select below functions.2

00

PV Alarm Functions
- 0 : None
- 1 : Absolute Value High Low Band Alarm
- 2 : Absolute Value High Alarm
- 3 : Absolute Value Low Alarm
- 4 : Absolute Value High Low Range Alarm

Additional Alarm Function
- 0 : None
- 1 : Alarm Output Hold
- 2 : Stand-by Sequence
- 3 : Stand-by Sequence & Hold

[F]Next [C]Back

(Alarm 2 Function > 0) / (Alarm 2 Function = 0) >>

High limit Setting For Alarm 2

ALH2 — 0 — Set high limit value for alarm 2. (ALL2 - 30000)

[F]Next [C]Back

Low limit Setting For Alarm 2

ALL2 — 0 — Set Low limit value for alarm 2. (0 - ALH2)

[F]Next [C]Back

Hysteresis Setting For Alarm 2

HYS2 — 0 — Set hysteresis when required (0 to ALH-ALL)

[F]Next [C]Back

Delay Time On Alarm 2

ton2 — 0 — Set delay time (Alarm on) when required. (0 - 60s)

[F]Next [C]Back

Delay Time Off Alarm 2

toFF2 — 0 — Set delay time (Alarm off) when required. (0 - 60s)

[F]Next [C]Back

Function Setting for Alarm 3

ALF3 — 0 — Select below functions. 3

00

PV Alarm Functions
- 0 : None
- 1 : Absolute Value High Low Band Alarm
- 2 : Absolute Value High Alarm
- 3 : Absolute Value Low Alarm
- 4 : Absolute Value High Low Range Alarm

Additional Alarm Function
- 0 : None
- 1 : Alarm Output Hold
- 2 : Stand-by Sequence
- 3 : Stand-by Sequence & Hold

[F]Next [C]Back

(Alarm 3 Function > 0) / (Alarm 3 Function = 0) >>

High limit Setting For Alarm 2

ALH3 — 0 — Set high limit value for alarm 3. (ALL3 - 30000)

[F]Next [C]Back

Low limit Setting For Alarm 2

ALL3 — 0 — Set Low limit value for alarm 3. (0 - ALH3)

[F]Next [C]Back

Hysteresis Setting For Alarm 3

HYS3 — 0 — Set hysteresis when required (0 to ALH-ALL)

[F]Next [C]Back

Delay Time On Alarm 3

ton3 — 0 — Set delay time (Alarm on) when required. (0 - 60s)

[F]Next [C]Back

Delay Time Off Alarm 3

toFF3 — 0 — Set delay time (Alarm off) when required. (0 - 60s)

[F]Next [C]Back

Baud Rate Communication

bPS — 9.6 — เลือกความเร็วของการสื่อสาร

2.4	2400 bps	19.2	19200 bps
4.8	4800 bps	38.4	38400 bps
9.6	9600 bps	57.6	57600 bps

[F]Next [C]Back

Communication Setting

Comm — b8n1 — เลือก Stop bit / Parity bit

b8n1
- Parity bit: n : None; E : Even; o : Odd
- Stop bit: 1 : 1 Stop bit; 2 : 2 Stop bit

[F]Next [C]Back

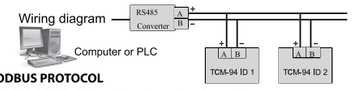
Address Setting

Adr — 1 — การตั้งค่า Address ของอุปกรณ์ ตั้งได้ 1-127

SERIAL COMMUNICATION

The TCM-94 are equipped with a RS485 serial communications interface to allow connection to computers or PLCs. MODBUS protocal is provided as standard communication. The user can connect TCM-94 as network up to 255 meters.

Wiring diagram



MODBUS PROTOCOL

This MODBUS Protocol has been implement in accordance with MODBUS.ORG MODBUS Application Protocol Specification V1.1 With the following conditions applying.
The following conditions apply
Baudrate can selected refer
22.Speed setting
The format is MODBUS RTU
UART data can selected refer **23.Communication** setting
Data is considered to be half duplex using 2 wire.

Modbus Function codes

Function code	Operation	Brodcast
04	Read Multiple Registers	Yes
06	Preset Single Register	Yes
08	Loop Back Diagnostic	No

Modbus Exception codes

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server (or slave).
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server (or slave)
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for server (or slave).

Example of a client request and server exception response

Request		Response	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	04	Function	84
Starting Address Hi	00	Exception Code	02
Starting Address Lo	00	CRC Hi	C2
Quantity of Input Reg. Hi	00	CRC Lo	C1
Quantity of Input Reg. Lo	1E		
CRC Hi	70		
CRC Lo	02		

Modbus RTU Table TCM-94

Address		Contents	Format	Word	Access	Range	
Decimal	Hex					Min	Max
0	0	Status of Alarm	Unsignde int	1	Read Only	-	-
1	1	Amps	Unsignde int	1	Read Only	-	-
2	2	Amps Peak	Unsignde int	1	Write/Read	0	0
3	3	-	-	-	-	-	-
4	4	Input	Unsignde int	1	Write/Read	0	1
5	5	Multiplier	Unsignde int	1	Write/Read	1	4000
6	6	Divisor	Unsignde int	1	Write/Read	1	1000
7	7	PV Adjust	Unsignde int	1	Write/Read	-1999	1999
8	8	PV Filter	Unsignde int	1	Write/Read	0	15
9	9	Decimal Point	Unsignde int	1	Write/Read	0	1.0
10	A	Lock Key	Unsignde int	1	Write/Read	0	3
11	B	Analog Input Absolute	Unsignde int	1	Write/Read	0	1
12	C	Analog Input High Limit	Unsignde int	1	Write/Read	0/0	75/150
13	D	Analog Input Low Limit	Unsignde int	1	Write/Read	0/0	75/150
14	E	Setting Limit High	Unsignde int	1	Write/Read	SLL	30000
15	F	Setting Limit Low	Unsignde int	1	Write/Read	0	SLH
16	10	-	-	-	-	-	-
17	11	Analog Output Inverse	Unsignde int	1	Write/Read	0	1
18	12	Analog Output High Limit	Unsignde int	1	Write/Read	SLL	SLH
19	13	Analog Output Low Limit	Unsignde int	1	Write/Read	SLL	SLH
20	14	Function Alarm 1	Unsignde int	1	Write/Read	0	34
21	15	High Alarm 1	Unsignde int	1	Write/Read	ALL1	30000
22	16	Low Alarm 1	Unsignde int	1	Write/Read	0	ALH1
23	17	Hysterisis Alarm 1	Unsignde int	1	Write/Read	0	ALH1-ALL1
24	18	Delay On Alarm 1	Unsignde int	1	Write/Read	0	60
25	19	Delay Off Alarm 1	Unsignde int	1	Write/Read	0	60
26	1A	Function Alarm 2	Unsignde int	1	Write/Read	0	34
27	1B	High Alarm 2	Unsignde int	1	Write/Read	ALL2	30000
28	1C	Low Alarm 2	Unsignde int	1	Write/Read	0	ALH2
29	1D	Hysterisis Alarm 2	Unsignde int	1	Write/Read	0	ALH2-ALL2
30	1E	Delay On Alarm 2	Unsignde int	1	Write/Read	0	60
31	1F	Delay Off Alarm 2	Unsignde int	1	Write/Read	0	60
32	20	Function Alarm 3	Unsignde int	1	Write/Read	0	34
33	21	High Alarm 3	Unsignde int	1	Write/Read	ALL3	30000
34	22	Low Alarm 3	Unsignde int	1	Write/Read	0	ALH3
35	23	Hysterisis Alarm 3	Unsignde int	1	Write/Read	0	ALH3-ALL3
36	24	Delay On Alarm 3	Unsignde int	1	Write/Read	0	60
37	25	Delay Off Alarm 3	Unsignde int	1	Write/Read	0	60

Here is an example of a request to read (PV) input register 1-2: (Function code 04)

Request		Response	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	04	Function	04
Starting Address Hi	00	Byte Count	04
Starting Address Lo	00	Input Reg. 1 Hi	00
Quantity of Input Reg. Hi	00	Input Reg. 1 Lo	00
Quantity of Input Reg. Lo	02	Input Reg. 2 Hi	00
CRC Hi	71	Input Reg. 2 Lo	DC
CRC Lo	CB	CRC Hi	FA
		CRC Lo	1D

The contents of input register 1-2 are shown as the 4 bytes values of 00 00 00 DC hex, or 220 decimal.

Here is an example of a request to write input register 5 to 03 E8 hex: (Function 06)

Request		Response	
Field Name	(Hex)	Field Name	(Hex)
Slave Address	01	Slave Address	01
Function	06	Function	06
Register Address Hi	00	Register Address Hi	00
Register Address Lo	04	Register Address Lo	00
Register Value Hi	03	Register Value Hi	03
Register Value Lo	E8	Register Value Lo	E8
CRC Hi	C8	CRC Hi	C8
CRC Lo	B5	CRC Lo	B5

TCM-94N-1/TCM-94N-2

บริษัท ไพรมัส จำกัด
119 ซ.สี่มุมองอนุสรณ์ ถ.สุทธิสารวินิจฉัย แขวงดินแดง
เขตดินแดง กรุงเทพ 10400
โทร 0-2693-7005, 0-2277-8027 แฟกซ์ 0-2277-3565
E-mail : sales@primusthai.com