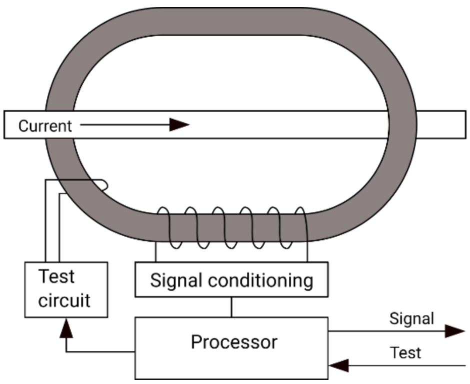
Overview

The **ATM2802-Y** is a compact solution for AC basic charging leakage current sensor with analog output for leakage current indication.



Applications

Typical applications include residual current sensor for In-Cable Control and Protection Devices (IC-CPD) or Wallbox.

Benefits

- Small size with fluxgate-based current sensor
- High resolution
- PCB mounting
- Conform to IEC62752:2016
- Conform to UL 2231-2
- RoHS compliant

Website: ambo.com.tw
Email: Tyrone@ambo.com.tw

Ordering Information

ATM2802 -Y R10

ATM2802 → Module Name

R10 → Revision

Dimensions

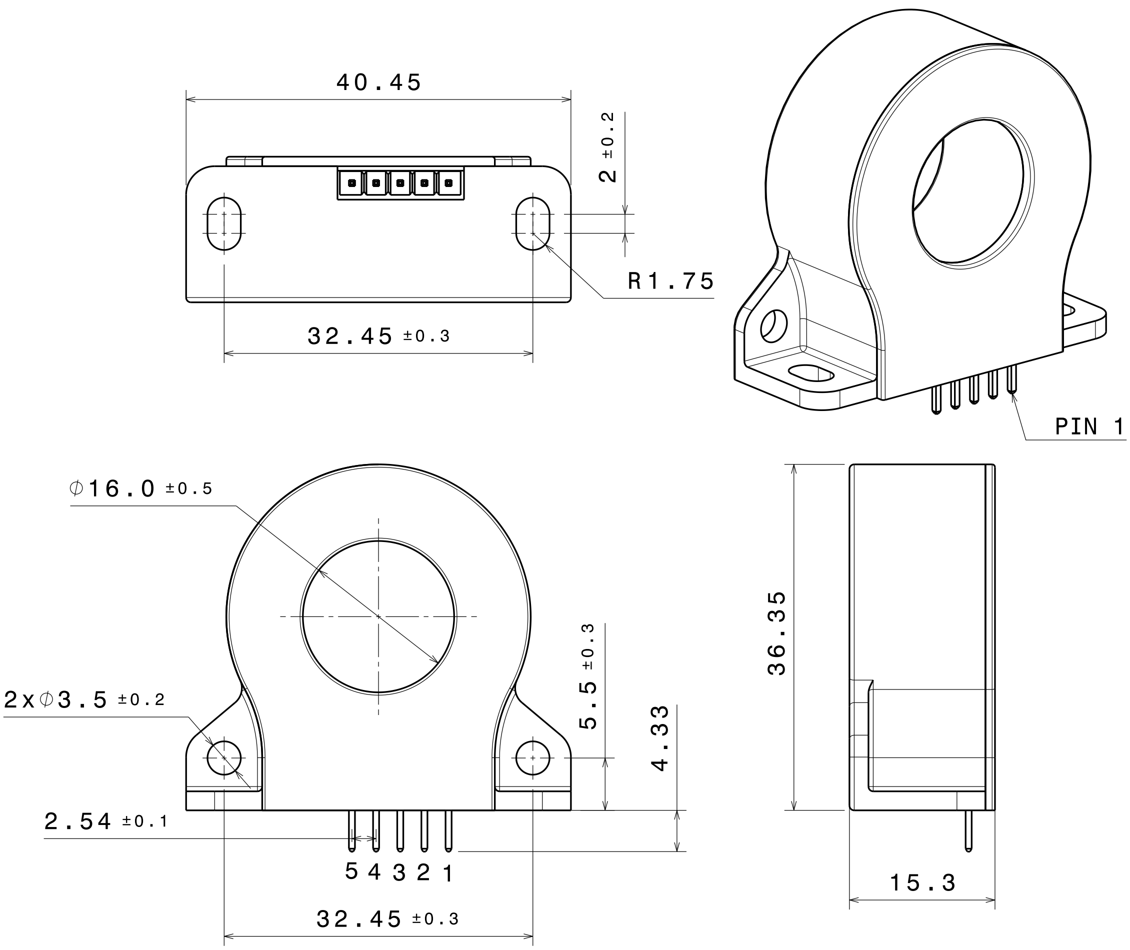


Figure 1: Module dimensions (unit: mm)

PCB Footprint

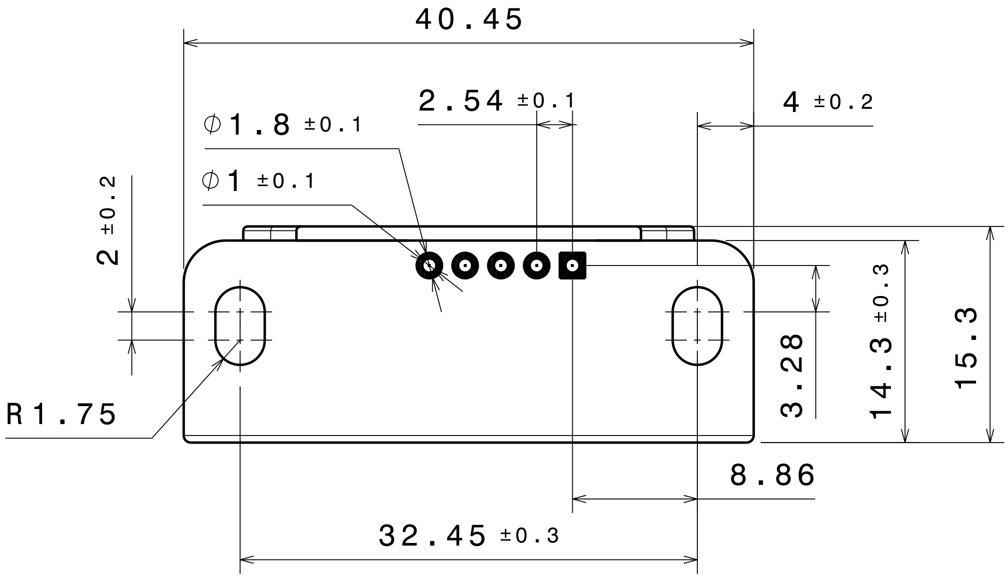


Figure 2: Footprint (bottom view - unit: mm)

Pinout

Pin Number	Symbol	Pin Type	Function
1	NC	Signal	Reserved
2	TEST	Input	Test input
3	OUT	Output	Output signal (3V logic)
4	VCC	Power	Power supply (5V)
5	GND	Power	Ground

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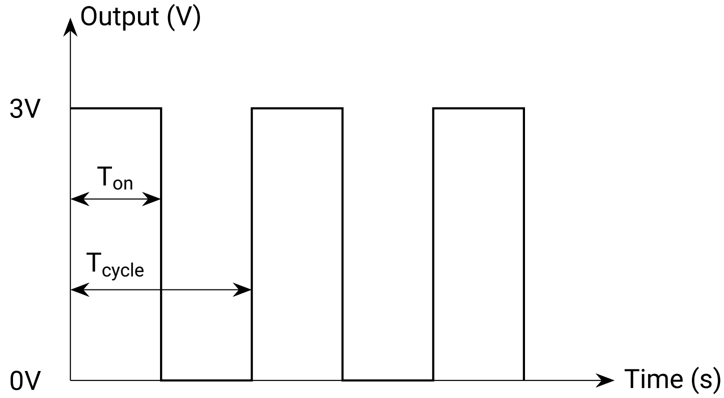
Output Characteristics



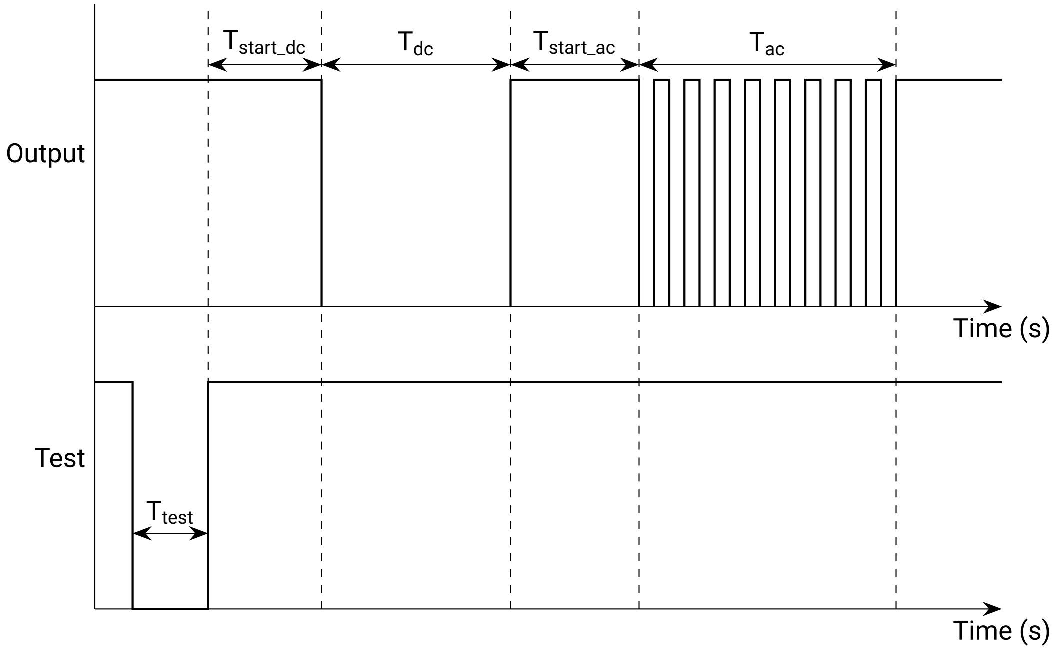
Symbol	Value
T_{on}	0.1ms - 1ms
T_{cycle}	1ms

Output state

Duty	Meaning
0%	DC alarm
10%	AC+DC alarm [1]
50%	AC alarm
90%	Reserved [2]
100%	Normal condition

[1] This duty cycle may be used to indicate other errors
[2] Reserved for internal check

Self-test sequence



Symbol	Min	Max
T_{test}	300ms	2s
T_{start_dc}		1s
T_{dc}		1s
T_{start_ac}		600ms
T_{start_ac}		600ms
T_{ac}		600ms

Specifications

Item	Performance Characteristics
Primary Rated Voltage	250 V
Primary Nominal Current	40/20 A Maximum (1 phase/3 phase)
Supply Voltage Range	4.75 – 5.25 V (5 V typical)
Maximum Input Voltage of Digital Output	Supply Voltage + 0.3 V
Maximum Sink Current of Digital Output	10 mA
Current Consumption	3 mA (at measurement 0 mA)
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−40°C to +85°C

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Test Results

ESD Test

DC Detection Current within specifications after ESD test.

Parameter	Result
Electrostatic Discharge Voltage, Human-Body Model (HBM) R = 1,500Ω, C = 100pF, U= ±2,000V	Passed
Electrostatic Discharge Voltage, Charged-Device Model (CDM) U=±800V	Passed

EMC Test

DC Alarm and AC Alarm do not malfunction during noise stimulation.

Parameter	Condition	Result
IEC 61000-4-3 Radiated, radio-frequency, electromagnetic field immunity	30 V/m, 80 MHz – 1 GHz 80% AM 1 kHz	Passed
ISO 11452-2 (ALSE) Electrical disturbances from narrowband radiated electro-magnetic energy	50 V/m 200 MHz – 800 MHz 80% AM 1 kHz, 800 MHz – 2 GHz PM	Passed
ISO 11452-4 (BCI) Electrical disturbances from narrowband radiated electro-magnetic energy	100 mA 20 MHz – 200 MHz 80% AM 1 kHz	Passed

Dielectric Strength

IEC 61800-5-1:2007

Parameter	Condition	Values
UW, prim-sec	Impulse (1.2 μs/50 μs), PIN 1- vs insulated primary wire, 5 pulse → polarity +, 5 pulse → polarity -	5500 Vrms
Ud	Test voltage, 60 seconds PIN 1-8 vs insulated primary wire	1500 Vrms
$U_{PDx1.5}$	Partial discharge voltage, PIN 1-8 vs insulated primary wire	1200 Vrms
$U_{PDx1.85}$	Partial discharge voltage, PIN 1-8 vs insulated primary wire	1500 Vrms

IEC62752-2016

AC Test

Test case: 9.7.3.2 Verification of the correct operation in case of a steady increase of the residual current.

Test setup:

- Use the setup shown in Figure 3.
- Function generator: Sin wave, 50Hz
- Increase amplitude manually (0.1mA step)
- When the DUT is alarm, record the meter's value

Test case: 9.7.3.3 Verification of the correct operation at closing on residual current.

Test setup:

- Use the setup shown in Figure 3.
- Function generator: Sin wave, 50Hz
- The test current calibrated at 30, 60, or 150mA
- Turn off the output of function generator, then turn on again
- Record the break time

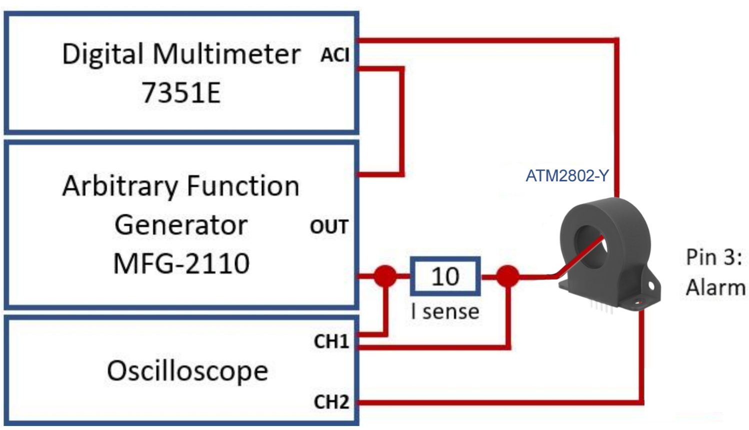

Figure 3: Test setup for 9.7.3.2, 9.7.3.3 and 9.7.4.2

Test case: 9.7.3.5 Verification of the correct operation in case of sudden appearance of residual current between 5A and 100A.

Test setup:

- Use the setup shown in Figure 4.

- The test current calibrated at 5, 10, 20, 50, 100A
- Turn on the output
- Record the break time

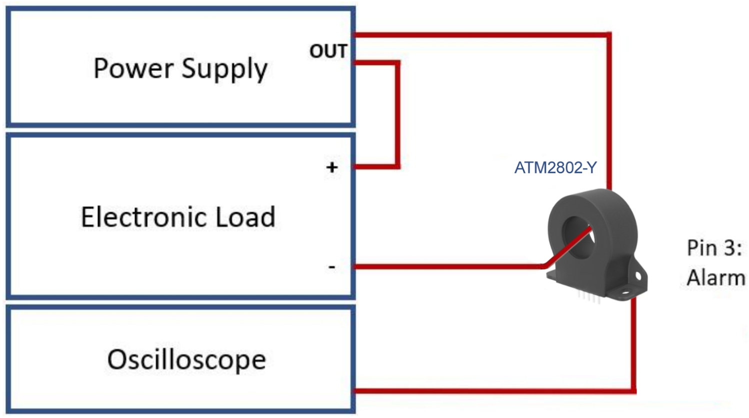

Figure 4: Test setup for 9.7.3.5

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Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
	9.7.3.2	15mA < I < 30mA	19.56mA	19.59mA	19.59mA	19.59mA	19.59mA	Pass
Idn	9.7.3.3	t < 300ms	66ms	73ms	69ms	70ms	90ms	Pass
2 ×Idn	9.7.3.3	t < 150ms	46ms	45ms	45ms	44ms	44ms	Pass
5 ×Idn	9.7.3.3	t < 40ms	5.6ms	5.2ms	8.8ms	6.4ms	8ms	Pass
5A	9.7.3.5	t < 40ms	2.2ms	2.5ms	3.9ms	2.4ms	3ms	Pass
10A	9.7.3.5	t < 40ms	4.2ms	2.9ms	2.9ms	1.9ms	3.3ms	Pass
20A	9.7.3.5	t < 40ms	4.5ms	2.7ms	3.2ms	3ms	3.1ms	Pass
50A	9.7.3.5	t < 40ms	2.5ms	1.9ms	2.2ms	2.4ms	2.6ms	Pass
100A	9.7.3.5	t < 40ms	2.7ms	1.8ms	1.7ms	2ms	2.4ms	Pass

Pulsating DC Test

Test case: 9.7.4.2 Verification of the correct operation in case of a continuous raise of a residual pulsating direct current.

Test setup:

- Use the setup shown in Figure 3.
- Function generator: pulsating direct current as shown in Figure 5
- Increase amplitude manually (0.1mA step)
- When the DUT is alarm, record the ammeter's value [rms]
- Measure similarly in the case of two phases

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- Repeat with α=90 and α=135

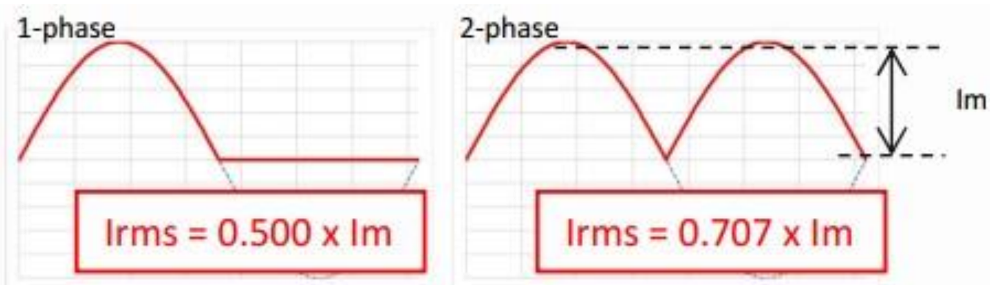

Figure 5: Output waveform for 9.7.4.2, α=0

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Test case: 9.7.4.3 Verification of the correct operation in case of suddenly appearing residual pulsating direct currents with or without being superimposed by a smooth direct current.

Test setup for without DC case:

- Use the setup shown in Figure 3.
- Function generator: pulsating direct current α=0 as shown in Figure 5
- Increase amplitude manually (0.1mA step)
- When the DUT is alarm, record the ammeter's value [rms]
- Measure similarly in the case of two phases
- Repeat with α=90 and α=135

Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
1 phase, α=0	9.7.4.2	4.2mA - 42mA	7.3mA	7.1mA	7.2mA	7.2mA	7.1mA	Pass
2 phase, α=0	9.7.4.2	4.2mA - 42mA	4.7mA	4.7mA	4.6mA	4.65mA	4.6mA	Pass
1 phase, α=90	9.7.4.2	6.3mA - 42mA	7.5mA	7.2mA	7.15mA	7.3mA	7.3mA	Pass
2 phase, α=90	9.7.4.2	6.3mA - 42mA	5.3mA	5.2mA	5.4mA	5.2mA	5.1mA	Pass
1 phase, α=135	9.7.4.2	3.3mA - 42mA	11.2mA	11.3mA	11mA	11.1mA	11.2mA	Pass
2 phase, α=135	9.7.4.2	3.3mA - 42mA	9.3mA	9.1mA	9.3mA	9.3mA	9.2mA	Pass
Idn$\times$1.4	9.7.4.3	t < 300ms	29ms	27ms	27.2ms	28ms	28ms	Pass
2$\times$Idn $\times$1.4	9.7.4.3	t < 150ms	6.2ms	6.8ms	6.8ms	6.8ms	6.8ms	Pass
5$\times$Idn $\times$1.4	9.7.4.3	t < 40ms	5.6ms	7ms	6.5ms	6ms	5.1ms	Pass
Idn$\times$1.4 + DC6mA	9.7.4.3	t < 300ms	24.8ms	25ms	24ms	24.8ms	25ms	Pass
2$\times$Idn$\times$1.4 + DC6mA	9.7.4.3	t < 150ms	7.3ms	6.3ms	7.8ms	6.8ms	7ms	Pass
5$\times$Idn$\times$1.4 + DC6mA	9.7.4.3	t < 40ms	5.6ms	6.1ms	5.5ms	5.8ms	5.8ms	Pass

Composite Current

Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
50/60Hz + 1kHz	9.7.5.2	15mA - 42mA	26.73mA	27mA	26.97mA	26.79mA	26.91mA	Pass
5×Idn×1.4	9.7.5.2	t < 40ms	11.3ms	10.5ms	10.7ms	11.1ms	10.1ms	Pass

Smooth DC

Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
	9.7.6	3mA - 6mA	4.4mA	4.4mA	4.6mA	4.4mA	4.5mA	Pass
6mA	9.7.6	t < 10s	290ms	290ms	313ms	298ms	303ms	Pass
60mA	9.7.6	t < 30ms	18.6ms	18.4ms	18.8ms	18.3ms	19.1ms	Pass
300mA	9.7.6	t < 40ms	8.2ms	8.0ms	7.6ms	8.2ms	7.8ms	Pass

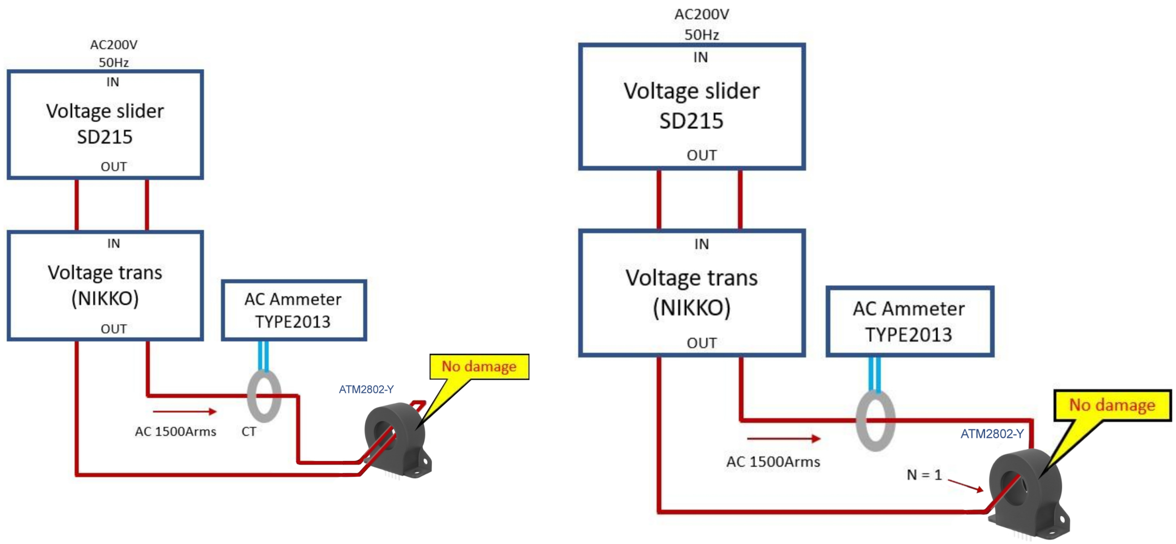
DC Current from Rectifying Circuits (2-phase)

Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
	9.7.11	3.5mA - 7mA	4.95mA	4.86mA	4.92mA	4.89mA	4.86mA	Pass
2×Idn	9.7.11	t < 300ms	23.6ms	21.6ms	21.2ms	21.6ms	22.4ms	Pass
4×Idn	9.7.11	t < 150ms	7.6ms	10.6ms	7.2ms	7ms	7.3ms	Pass
10×Idn	9.7.11	t < 40ms	10ms	4.8ms	3.8ms	4.2ms	7.2ms	Pass
5A	9.7.11	t < 40ms	2.2ms	2.8ms	2.6ms	2.2ms	2.7ms	Pass
10A	9.7.11	t < 40ms	2.5ms	3.0ms	3.2ms	2.8ms	2.1ms	Pass
20A	9.7.11	t < 40ms	2.0ms	1.8ms	2.0ms	2.1ms	2.4ms	Pass
50A	9.7.11	t < 40ms	1.9ms	2.0ms	2.7ms	2.5ms	2.0ms	Pass

DC Current from Rectifying Circuits (3-phase)

Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
	9.7.12	3.5mA - 6.2mA	3.7mA	3.6mA	3.6mA	3.7mA	3.7mA	Pass
2×Idn	9.7.12	t < 300ms	18ms	19.6ms	18.4ms	19.2ms	18ms	Pass
4×Idn	9.7.12	t < 150ms	21ms	21.6ms	22ms	22ms	22.8ms	Pass
10×Idn	9.7.12	t < 40ms	6ms	5.2ms	5.2ms	5.6ms	5.2ms	Pass
5A	9.7.12	t < 40ms	2.3ms	2.5ms	2.3ms	2.6ms	2.4ms	Pass
10A	9.7.12	t < 40ms	2.3ms	2.4ms	2.2ms	2.8ms	2.1ms	Pass
20A	9.7.12	t < 40ms	2.2ms	1.8ms	2.5ms	2.1ms	2.4ms	Pass
50A	9.7.12	t < 40ms	1.8ms	2.1ms	2.5ms	2.5ms	2.1ms	Pass

Short Circuit



(a) I_n (b) I_d

Figure 6: Test setup for 9.9.2.2, 9.9.2.3, 9.9.2.4

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Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
In: 320A Id: 300mA	9.9.2.2	No damage	No damage	No damage	No damage	No damage	No damage	Pass
In: 320A	9.9.2.3	No damage	No damage	No damage	No damage	No damage	No damage	Pass
In: 1500A	9.9.2.4	No damage	No damage	No damage	No damage	No damage	No damage	Pass
Id: 1500A	9.9.2.4	No damage	No damage	No damage	No damage	No damage	No damage	Pass

Surge Currents

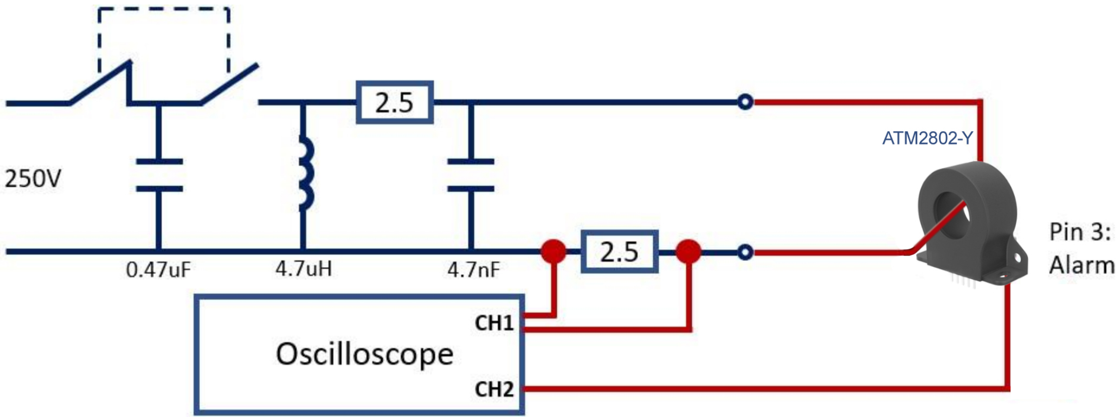

Figure 7: Test setup for 9.16

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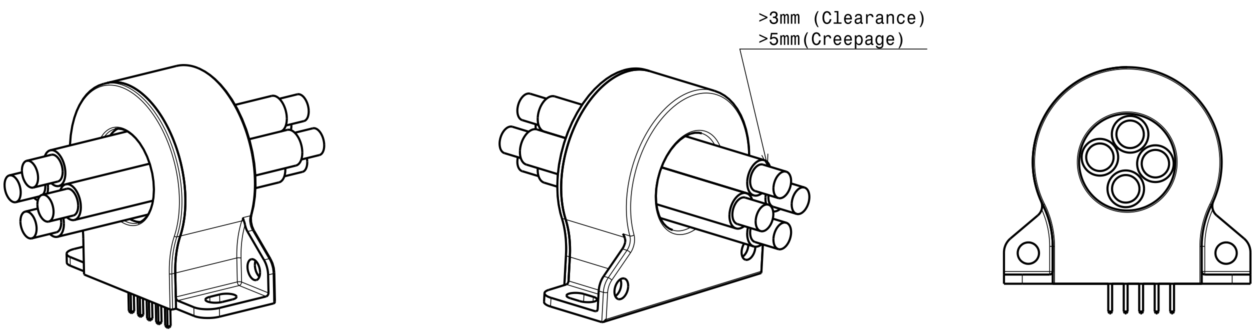
Condition	IEC62752	Condition	#1	#2	#3	#4	#5	Result
25Ap,100kHz	9.16	NOT trip	NOT trip	NOT trip	NOT trip	NOT trip	NOT trip	Pass

EMI

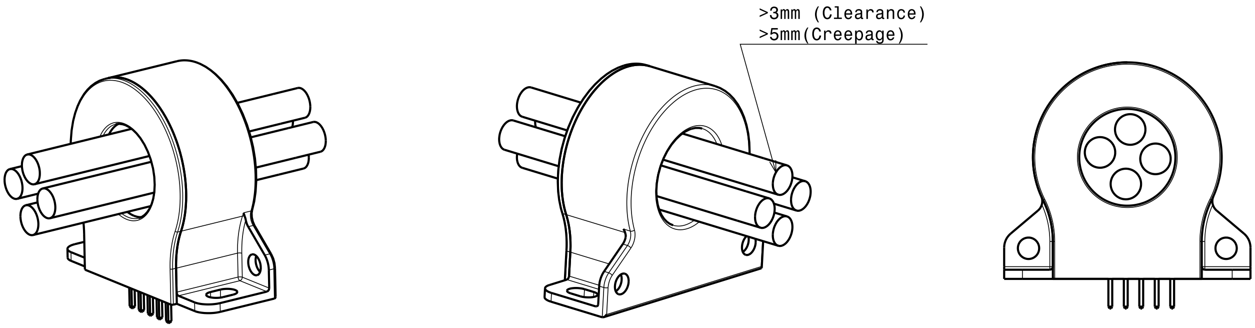
Recommended Wire Configurations

In Case of Insulated Wire

Three phase system < 480V



In Case of Bare Wire



Reinforced insulation, insulation material group III, pollution degree 2, altitude < 5,000 m and overvoltage category II. Please take enough creepage distance between each pin.

Soldering Process

Soldering Process: Manual Soldering

Soldering Temperature: 360±10 °C

Soldering Time: 3±1 s

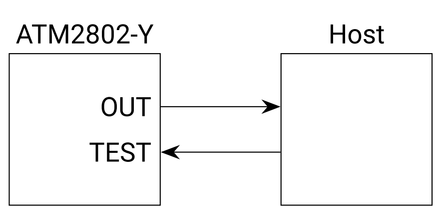
Packaging

Part Name	Packaging Type	Pieces Per Box
ATM2802-Y	Tray	100

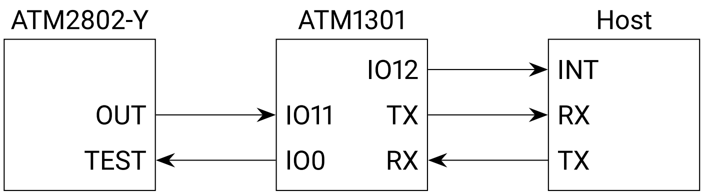
The product is packed in anti-static trays.

Recommended Circuit

Typical circuit



Recommended circuit with ATM1301 module



Ratings

	Min	Typical	Max	Response time
DC Detection Current (mA)	3	4.5	6	1s at 6mA 100ms at 60mA 15ms at 300mA
AC Detection Current (mArms)	15	17.5	30	200ms at 30mA 60ms at 60mA 15ms at 150mA

Handling Precautious

Precautions for Product Storage

Current sensors should be stored in normal working environments. While the sensors are quite robust in other environments, exposure to high temperatures, high humidity, corrosive atmospheres, and long-term storage degrade solderability.

AMBO recommends that maximum storage temperature not exceed 85°C and atmospheres should be free of chlorine and sulfur-bearing compounds. Temperature fluctuations should be minimized to avoid condensation on the parts. Avoid storage near strong magnetic fields, as they can magnetize the product and cause its characteristics to change. Limit ambient magnetic fields to 50e or less.

For optimized solderability, the stock of current sensors should be used within 12 months of receipt.

Before Using Fluxgate-Based Residual Current Sensors

- Do NOT drop or apply any other mechanical stress, as such stresses may change performance characteristics.
- Do NOT exceed 260°C for 10 seconds when soldering. This is the maximum heat resistance grade of these sensors. Use a low-corrosion type flux when soldering.
- Do NOT allow strong static electricity near the sensor, as the circuit uses ICs. Static electricity can cause damage. Take static electricity precautions when handling.
- The case is Insulation Materials Group III. When designing the primary wire, be careful of clearance and creepage distance from the input/output terminal.

Disclaimer

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Although AMBO designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicted or that other measures may not be required.

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