

# Gemini AMM

## Analogue Measurement Module



# Gemini Analogue Measurement Module

**The Gemini Analogue Measurement Module (AMM) is part of the Gemini Platform providing advanced 3 phase measurement of power system currents, voltages, power, energy, sequence components, power quality; and directional fault passage indication.**

The Gemini AMM is a physically separate extension of the Gemini 3 and Gemini 4 range of RTUs for extracting the power system information (e.g. V, I, P, F, FPI, etc.). The Gemini AMM's communicate with Gemini RTUs via CAN Bus or Ethernet. The CAN Bus provides a 'daisy-chain' connection from the Gemini RTU to up to 4 Gemini AMMs. The Ethernet provides a 'star' connection from the Gemini RTU to up to 4 Gemini AMMs via an Ethernet switch.

## Power and load monitoring

Load flow monitoring provides an essential understanding of the electrical load on the network avoiding overloading lines and primary plant. Power and energy monitoring to help improve network efficiency, losses and capacity, allowing more effective operation and better power factor management.

## Fault detection - reducing outages and revenue loss

The directional Fault Passage Indicator (FPI) provides rapid fault detection for single and three phase faults. Combined with the remote control and automation capabilities of Gemini RTUs, the outage time and resulting loss of revenue are minimised. Additionally, the FPI will co-ordinate with upstream reclosers to avoid unnecessary outages due to temporary faults such as clashing conductors.

## Network condition monitoring - early detection of network issues

Power quality measurements help understand if the electricity supply is suitable and compatible for use by the network operator's customers. Many of these factors are difficult to identify, and usually require observation over time. The Gemini AMM will capture power quality disturbances with preconfigured trigger points and provide essential information for improved decision making.

### Measurements

- 3 phase voltages (RMS & fundamental)
- 3 currents (RMS & fundamental)
- Derived neutral current
- Negative, positive and zero sequence voltage and currents

### Power and energy measurements

- Active & reactive power
- Aggregated active & reactive power
- Maximum and average energy demand
- Power factor
- Frequency

### Power quality

- Over voltage
- Under voltage
- Under frequency
- Current unbalance
- Voltage unbalance
- Phase current and voltages up to 20th order
- Current & voltage THD
- Sags, swells & interruptions

### Fault passage indication

- 3 phase & earth fault indication
- Inrush restraint
- Directional / non-directional
- Voltage memory & cross-polarised
- Inverse definite minimum time (IDMT) IEC and ANSI IEEE characteristics

### Applications

- Power quality
- Power measurement
- Fault passage indication
- Broken / open conductor detection
- Overhead and ground mount applications

### General features

- No batteries
- Ethernet communications
- CAN bus communications
- Can be used with instrument transformers compliant with IEC 61869-10 and IEC 61869-11
- Compliant with IEC 60255, IEC 61000 and IEC 680068 tests

# Models available

Parameter	AUT000414	AUT0007979 AUT0008014	AUT0004267
<b>Measurement</b>		•	
Voltage (L-N)	•	•	•
Voltage (L-N) Angle	•	•	•
Current	•	•	•
Current Angle	•	•	•
Voltage (L-L)	•	•	•
Voltage (L-L) Angle	•	•	•
Power Active	•	•	•
Power Apparent	•	•	•
Power Reactive	•	•	•
Power Factor	•	•	•
VZS(Voltage Zero Sequence) / VNS (Voltage Negative Sequence) / VPS(Voltage Positive Sequence)	•		
VZS / VNS / VPS Angle	•		
I DE (Derived Earth Current)	•		•
I DE Angle	•		
IZS(Current Zero Sequence)			
INS(Current Negative Sequence)	•		
IPS(Current Positive Sequence)			
IZS / INS / IPS Angle	•		
Energy Act/React/Appr	•		
Voltage THD(Total Harmonics Distortion)	•		
Current TDD(Total Demand Distortion)	•		
Frequency	•	•	•
<b>Fault passage indication</b>			
Directional / Non-directional 3 phase FPI (50/51/67)	•		•
Directional / Non-directional earth FPI (derived) (50N/51N/67N)	•		•
Inrush restraint	•		•
Broken conductor detection (46)	•		•
<b>Gemini AMM Power Quality Functions</b>			
a. Voltage Sag (VT1)	•		•
b. Voltage Swell (VT1)	•		•
c. Over Voltage THD (VT1)	•		•
d. Over Current TDD (CT1)	•		•
e. Voltage Interruption (VT1)	•		•
f. Under Frequency 81U (VT1)	•		•
g. Under Voltage 27 (VT1)	•		•
h. Over Voltage 59 (VT1)	•		•
i. Over Current 50/51 (CT1)	•		•
j. Unbalance Voltage 47 (VT1)	•		•
k. Unbalance Current 46 (CT1)	•		•
l. Direction Phase Fault 67 (CT1)	•		•
m. Over Current Earth 50N/51N (CT1)	•		•
n. Directional Earth fault 67N (CT1)	•		•
o. Permanent & Temporary Fault Identification	•		•

# Model: AUT0004141

## Measurement inputs

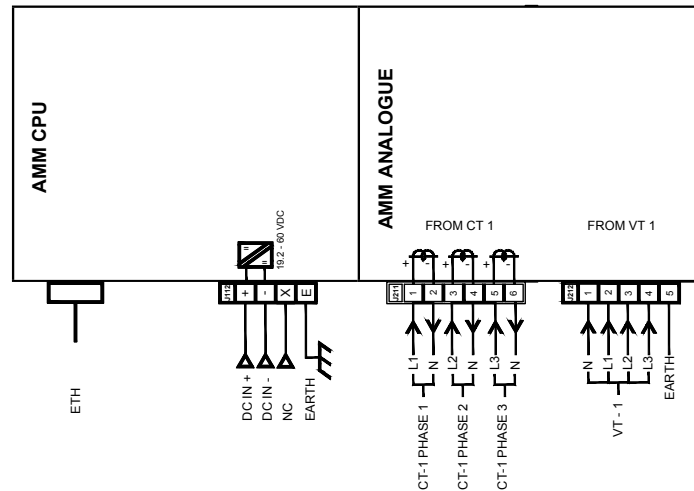
Current inputs: 3 x 1/5 A AC  
Voltage inputs: 3 x 110 V AC

## Communications

Ethernet

## Power supply inputs

19.2 – 60 V DC



## Fault passage indication

Parameter	Setting range
Directional / Non-directional 3 phase FPI	0.1 to 20 In**
Directional / Non-directional earth FPI (derived)	0.1 to 20 In**
Inrush restraint	2nd harmonic 5 - 50%
Broken conductor detection	I2/I1 ratio 20-100%

\*\*Maximum setting range is up to 20A secondary

## Accuracy details

Parameter	Input range	Accuracy
Voltage (L-N)	10 V to 150 V (L-N)	± 0.25%
Voltage (L-N) Angle	10 V to 150 V (L-N)	± 0.5 Degree
Current	0.051 A to 0.750 A 0.750 A to 20 A	± 0.25% ± 5mA ± 0.25%
Current Angle	0.051 A to 20 A	± 0.5 Degree
Voltage (L-L)	10 V to 150√3 V	± 0.25%
Voltage (L-L) Angle	10 V to 150√3 V	± 0.5 Degree
Power Active	0.051 A to 0.750 A 10 V to 150 V (L-N) 0.750 A to 20 A 10 V to 150 V (L-N)	± 1.25% ± 1.0%
Power Apparent	0.051 A to 0.750 A 10 V to 150 V (L-N) 0.750 A to 20 A 10 V to 150 V (L-N)	± 1.25% ± 1.0%
Power Reactive	0.051 A to 0.750 A 10 V to 150 V (ph-n) 0.750 A to 20 A 10 V to 150 V (ph-n)	± 1.75% ± 1.25%
Power Factor	0.051 A to 20 A 10 V to 150 V (L-N)	± 0.01
Energy Act/React/Appr	0.051 A to 20 A 10 V to 150 V (L-N)	± 1% for 1 hr
Voltage THD(Total Harmonics Distortion)	10 V to 150 V (L-N) upto 20th order harmonic	± 5% Abs
Current TDD(Total Demand Distortion)	0.051 A to 1 A upto 20th order harmonic	± 5% Abs
Frequency	48 to 63 Hz	± 0.02 Hz

# Model: AUT0007979

## Measurement inputs

Current inputs: 9 x 225 mV AC

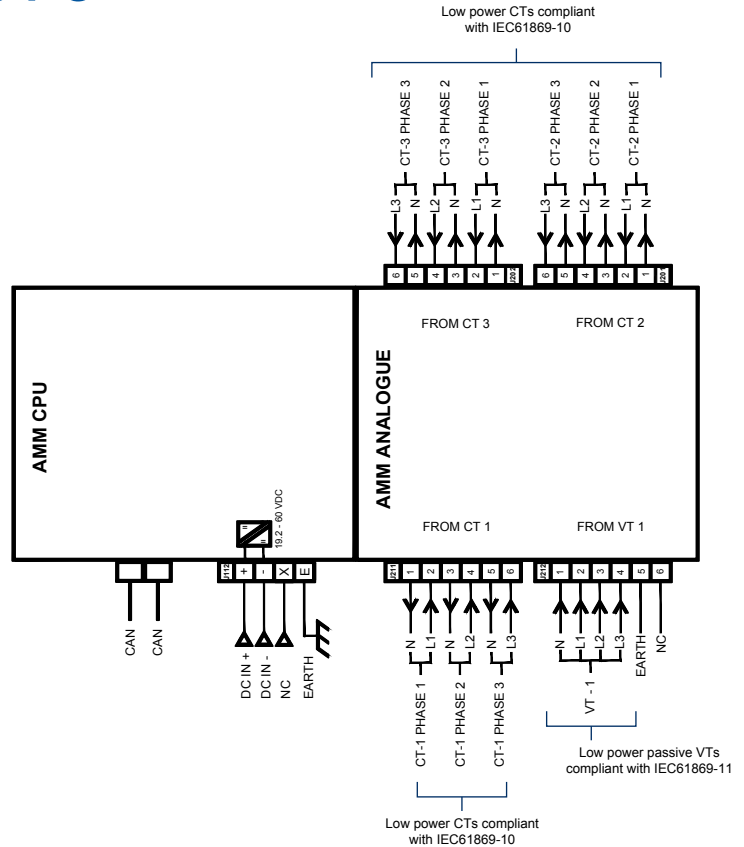
Voltage inputs: 3 x 3.25 V AC

## Communications

Can Bus

## Power supply inputs

19.2 – 60 V DC



## Accuracy details

Parameter	Input range	Accuracy
Voltage (L-N)	0.181 V to 3.50 V (L-N)	± 0.25%
Voltage (L-N) Angle	0.181 V to 3.50 V (L-N)	± 0.5 Degree
Current	0.01125 V to 0.050 V 0.051 V to 0.300 V	± 0.25% ± 5mV ± 0.25%
Current Angle	0.01125 V to 0.050 V 0.051 V to 0.300 V	± 0.7 Degree ± 0.5 Degree
Voltage (L-L)	0.181√3 V to 3.5√3 V (L-L)	± 0.25%
Voltage (L-L) Angle	0.181√3 V to 3.5√3 V (L-L)	± 0.5 Degree
Power Active / Apparent	CT: 0.01125 V to 0.050 V (L-N) VT: 0.181 V to 3.50 V CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 1.8%***
Power Reactive	CT: 0.01125 V to 0.050 V VT: 0.181 V to 3.50 V (L-N) CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 2.1%*** ± 2.86%***
Power Factor	CT: 0.01125 V to 0.050 V VT: 0.181 V to 3.50 V (L-N) CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 0.02*** ± 0.01***
Frequency	47 to 63 Hz	± 0.02 Hz

\*\*\*Declared accuracy levels are valid exclusively under nominal current conditions and at the rated secondary voltage.

\*\*\*Accuracy values are specified for three phase power calculations.

# Model: AUT0008014

## Measurement inputs

Current inputs: 6 x 225 mV AC

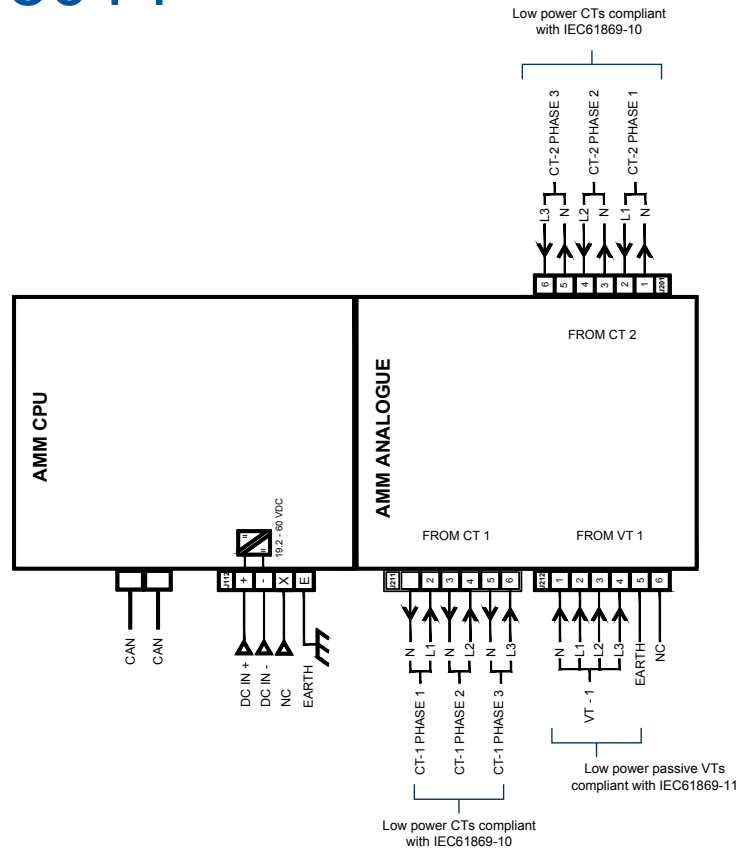
Voltage inputs: 3 x 3.25 V AC

## Communications

Can Bus

## Power supply inputs

19.2 – 60 V DC



## Accuracy details

Parameter	Input range	Accuracy
Voltage (L-N)	0.181 V to 3.50 V (L-N)	± 0.25%
Voltage (L-N) Angle	0.181 V to 3.50 V (L-N)	± 0.5 Degree
Current	0.01125 V to 0.050 V 0.051 V to 0.300 V	± 0.25% ± 5mV ± 0.25%
Current Angle	0.01125 V to 0.050 V 0.051 V to 0.300 V	± 0.7 Degree ± 0.5 Degree
Voltage (L-L)	0.181√3 V to 3.5√3 V (L-L)	± 0.25%
Voltage (L-L) Angle	0.181√3 V to 3.5√3 V (L-L)	± 0.5 Degree
Power Active / Apparent	CT: 0.01125 V to 0.050 V (L-N) VT: 0.181 V to 3.50 V CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 1.8%***
Power Reactive	CT: 0.01125 V to 0.050 V VT: 0.181 V to 3.50 V (L-N) CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 2.1%*** ± 2.86%***
Power Factor	CT: 0.01125 V to 0.050 V VT: 0.181 V to 3.50 V (L-N) CT: 0.051 V to 0.300 V VT: 0.181 V to 3.50 V (L-N)	± 0.02*** ± 0.01***
Frequency	47 to 63 Hz	± 0.02 Hz

\*\*\*Declared accuracy levels are valid exclusively under nominal current conditions and at the rated secondary voltage.

\*\*\*Accuracy values are specified for three phase power calculations.

# Model: AUT0004267

## Measurement inputs

Current inputs: 3 x 1/5 A AC

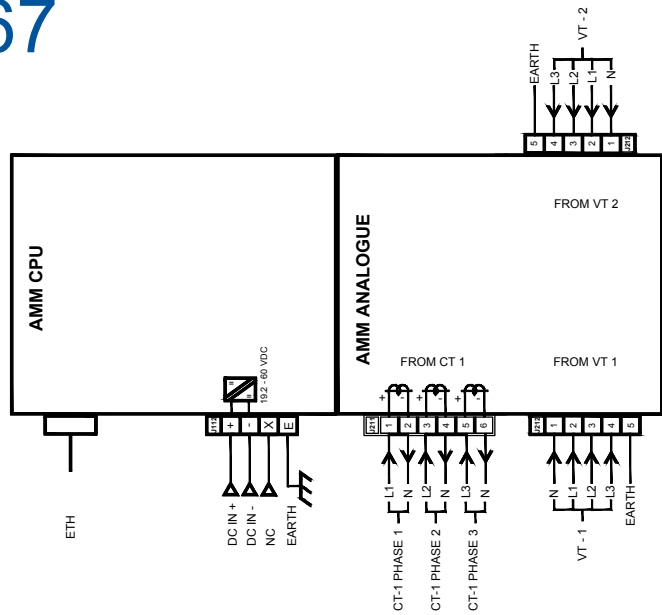
Voltage inputs: 6 x 4 V AC

## Communications

Ethernet

## Power supply inputs

19.2 – 60 V DC



## Fault passage indication

Parameter	Setting range
Directional / Non-directional 3 phase FPI	0.1 to 20 In**
Directional / Non-directional earth FPI (derived)	0.1 to 20 In**
Inrush restraint	2nd harmonic 5 - 50%
Broken conductor detection	I2/I1 ratio 20-100%

\*\*Maximum setting range is up to 20A secondary

## Accuracy details

Parameter	Input range	Accuracy
Voltage (L-N)	0.400 V to 0.800 V (L-N)	$\pm 0.25\% \pm 5\text{mV}$
	0.801 V to 5 V (L-N)	$\pm 0.25\%$
Voltage (L-N) Angle	0.400 V to 5 V (L-N)	$\pm 0.5$ Degree
Current	0.051 A to 0.750 A	$\pm 0.25\% \pm 5\text{mA}$
	0.750 A to 25 A	$\pm 0.25\%$
Current Angle	0.051 A to 25 A	$\pm 0.5$ Degree
Voltage (L-L)	$0.400\sqrt{3}$ V to $5\sqrt{3}$ V	$\pm 0.25\%$
Voltage (L-L) Angle	$0.400\sqrt{3}$ V to $5\sqrt{3}$ V	$\pm 0.5$ Degree
Power Active	0.051 A to 0.750 A	$\pm 1.25\%$
	0.400 V to 5 V (L-N)	
	0.750 A to 10 A	$\pm 1.0\%$
	0.400 V to 5 V (L-N)	
Power Apparent	0.051 A to 0.750 A	$\pm 1.25\%$
	0.400 V to 5 V (L-N)	
	0.750 A to 10 A	$\pm 1.0\%$
	0.400 V to 5 V (L-N)	
Power Reactive	0.051 A to 0.750 A	$\pm 1.75\%$
	0.400 V to 5 V (L-N)	
	0.750 A to 10 A	$\pm 1.25\%$
	0.400 V to 5 V (L-N)	
Power Factor	0.051 A to 10 A	$\pm 0.01$
	0.400 V to 5 V (L-N)	
Frequency	48 to 63 Hz	$\pm 0.02$ Hz

# Technical data

Protection Function	Parameter	Range	Unit	Default
<b>Fault passage detection</b>				
<b>Instantaneous phase overcurrent</b>				
Direction – ANSI 67	Polarization	CROSS, ZPS, NPS		CROSS
	Char Angle MTA	-90 to 90	Degree	0
	Voltage Startup	0.3 to 0.99	pu	0.10
	Voltage Memory	0 to 2000	mSec	1000
Over Current – ANSI 50	Current Pickup	0.1 to 20	In	0.1
	Delay	0.1 to 1600	Sec	15
	Dir Control	FWD,REV,NO DIR		FWD
<b>Time delayed phase overcurrent</b>				
Direction – ANSI 67	Polarization	CROSS, ZPS, NPS		CROSS
	Char Angle MTA	-90 to 90	Degree	0
	Voltage Startup	0.3 to 0.99	pu	0.10
	Voltage Memory	0 to 2000	mSec	1000
Over Current – ANSI 51	Current Pickup	0.1 to 20	In	0.1
	Delay	0.1 to 1600	Sec	15
	Dir Control	FWD,REV,NO DIR		FWD
	IDMT	IEC Inverse, Very Inverse, Extremely Inverse IEEE Moderately Inverse, Very Inverse, Extremely Inverse		
<b>Earth fault detection (derived)</b>				
<b>Instantaneous earth fault overcurrent</b>				
Direction – ANSI 67N	Polarization	ZPS or NPS		ZPS
	Char Angle MTA	-90 to 90	Degree	0
	Voltage Startup	0.3 to 0.99	pu	0.10
	Voltage Memory	0 to 2000	mSec	1000
Over Current – ANSI 50N	Current Pickup	0.1 to 20	In	0.1
	Delay	0.1 to 1600	Sec	15
	Dir Control	FWD,REV,NO DIR		FWD
<b>Time delayed earth fault overcurrent</b>				
Direction – ANSI 67N	Polarization	ZPS or NPS		ZPS
	Char Angle MTA	-90 to 90	Degree	0
	Voltage Startup	0.3 to 0.99	pu	0.10
	Voltage Memory	0 to 2000	mSec	1000
Over Current – ANSI 51N	Current Pickup	0.1 to 20	In	0.1
	Delay	0.1 to 1600	Sec	15
	Dir Control	FWD,REV,NO DIR		FWD
	IDMT	IEC Inverse, Very Inverse, Extremely Inverse IEEE Moderately inverse, Very Inverse, Extremely Inverse		

Note:

- ANSI 50 and ANSI 51 are mutually exclusive
- Maximum setting range is up to 20A secondary

# Technical data

Protection Function	Parameter	Range	Unit	Default
<b>Voltage &amp; frequency detection</b>				
Over Voltage – ANSI 59	Voltage Pickup	1.00 to 1.50	pu	1.00
	Drop Off	50 to 100	%	50
	Delay	0.1 to 1600	Sec	15
Under Voltage – ANSI 27	Voltage Pickup	0.3 to 0.99	pu	0.50
	Drop Off	100 to 110	%	100
	Delay	0.1 to 1600	Sec	15
Under Frequency – ANSI 81U	Freq Pickup	20 to 70	Hz	45.00
	Delay	0.1 to 1600	Sec	15
	Volt Inhibit	10 to 90	% of Vrated	10
<b>Unbalance detection</b>				
Unbalance Voltage – ANSI 47	Voltage Pickup	1.00 to 1.50	pu	1.00
	Delay	0.1 to 1600	Sec	15
Unbalance Current – ANSI 46NPS	Current Pickup	0.1 to 4	In	0.10
	Delay	0.1 to 1600	Sec	15

Protection Function	Parameter	Range	Unit	Default
<b>Power quality</b>				
Voltage SAG	Voltage Threshold	0.1 to 1.00	pu	1.00
	Instantaneous Time	0.5 to 30	cycles	30
	Momentary Time	0.5 to 3	Sec	0.5
	Temporary Time	0.5 to 60	Sec	15
Voltage SWELL	Voltage Threshold	0.1 to 1.00	pu	1.00
	Instantaneous Time	0.5 to 30	cycles	30
	Momentary Time	0.5 to 3	Sec	0.5
	Temporary Time	0.5 to 60	Sec	15
Voltage INTRP	Voltage Threshold	0.1 to 1.00	pu	1.00
	Momentary Time	0.5 to 3	Sec	0.5
	Temporary Time	0.5 to 60	Sec	15
	Sustain Time	0.5 to 600	Sec	60

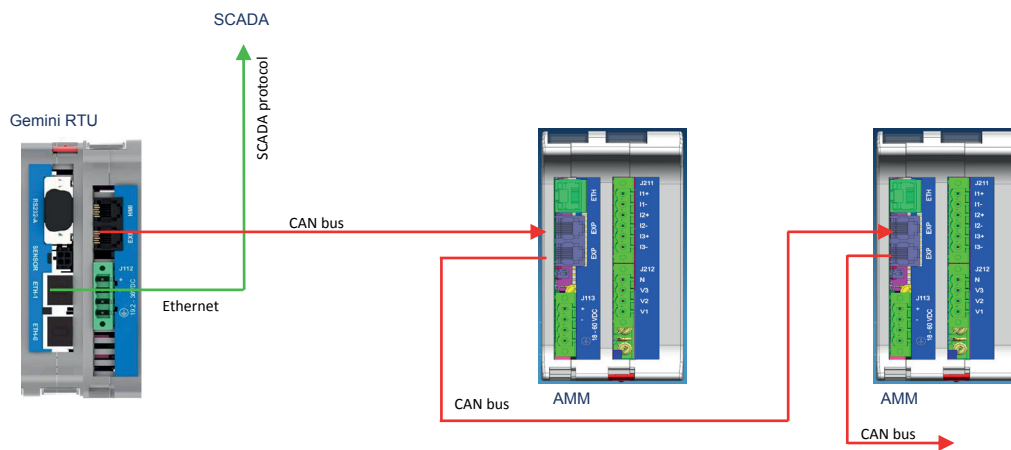
# Technical data

## Power supply requirements

The Analogue Measurement Module requires to be powered from a stable DC supply in the range 19.2-60 V DC, 6W.

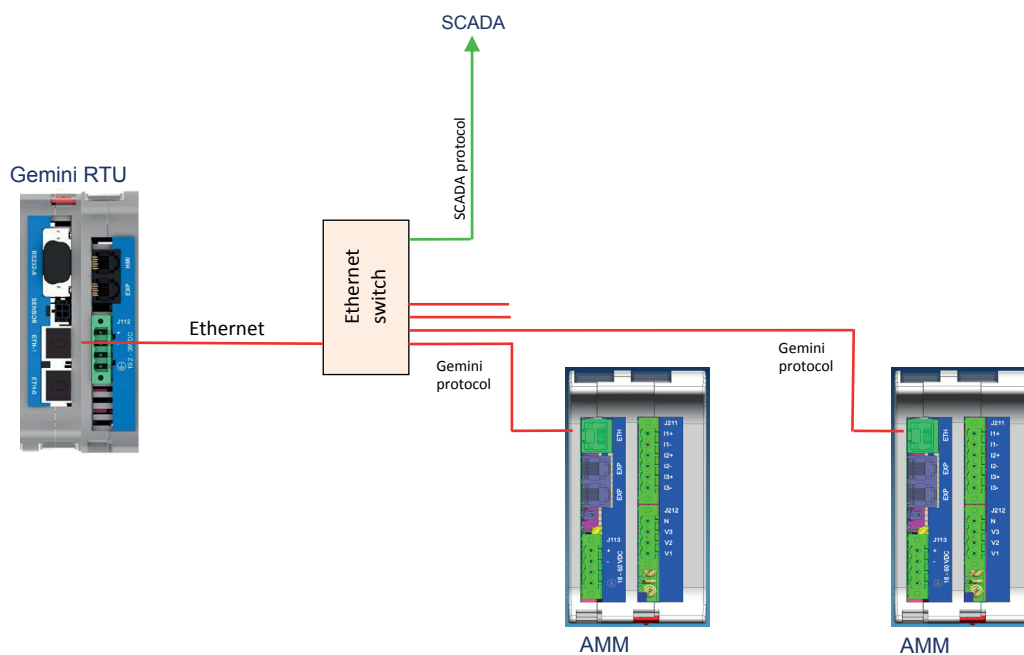
## Communications

CAN Bus



## Ethernet

(Using internal Gemini protocol)



# Technical data

## Environmental tests

Test	Standard	Description
Cold test operation	IEC 60068-2-1	Operational: $-25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 96 hours Storage: $-40^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 16 hours
Dry heat test	IEC 60068-2-2	Operational: $+70^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 96 hours Storage: $+85^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 16 hours
Cyclic temperature	IEC 60068-2-14	5 cycles, dwell time 3 hours $-25^{\circ}\text{C} \pm 3^{\circ}\text{C}/+70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , ramp state $1^{\circ}\text{C} \pm 0.2^{\circ}\text{C}/\text{min}$
Damp heat steady state test	IEC 60068-2-78	10 days $93\% \pm 3\%$ RH at $+40^{\circ}\text{C} \pm 2\%$
Cyclic temperature with humidity test	IEC 60068-2-30	6 of 24 h (12 h + 12 h) cycles $93\% \pm 3\%$ RH at $+55^{\circ}\text{C}$ and $>95\%$ RH at $+25^{\circ}\text{C}$
Degree of protection provided by enclosure (IP code)	IEC 60255-27 and IEC 60529	IP 20 RTU Electronics

## Mechanical tests

Test	Standard	Description
Vibration test	IEC 60068-2-6	Response Class 1, Endurance Class 1
Shock and bump test	IEC 60068-2-27	Class 1
Seismic test	IEC 60255-21-3	Class 1

## Electrical safety tests

Test	Standard	Description
Dielectric VoltageStrength	IEC 60255-27	Power supply port, current/voltage ports, earth ports, 2 kV, 1 minute
Impulse Voltage Strength	IEC 60255-27	Power supply port, current/voltage ports, earth ports, 5 kV peak, 1.2/50 $\mu\text{s}$ , 0.5 J
Electrical Safety (Insulation Resistance)	IEC 60255-27	Power supply port, current/voltage ports, earth ports $> 100 \text{ M}\Omega$ at 500 V d.c.

# Technical data

## Electromagnetic compatibility (EMC/EMI) tests

Test	Standard	Description
Electrostatic discharge immunity test	IEC 60255-26, IEC 61000-4-2	Level 3
Radiated, radio-frequency, electromagnetic field immunity test	IEC 60255-26, IEC 61000-4-3	Level 3
Electrical fast transient	IEC 60255-26, IEC 61000-4-4	Level 4
Surge immunity test	IEC 60255-26, IEC 61000-4-5	Level 4
Conducted interference	IEC 60255-26, IEC 61000-4-6	Level 3
Power frequency magnetic field immunity test	IEC 60255-26, IEC 61000-4-8	Level 4
Pulse magnetic field immunity test	IEC 61000-4-9	Level 5
Damped oscillatory magnetic field immunity test	IEC 61000-4-10	Level 5
Damped oscillatory wave immunity test - slow	IEC 60255-26, IEC 61000-4-18	Level 3
Radiated emission (below 1 GHz)	IEC 60255-26, CISPR 11	Class A
Radiated emission (above 1 GHz)	IEC 60255-26, CISPR 22	Class A
Conducted emission	IEC 60255-26, CISPR 22	Class A
Right wave test	IEC 61000-4-12	Level 3
DC voltage interruptions	IEC 60255-26, IEC 60255-4-29	Test level 0 % residual voltage

## Dimensions

Dimensions and mounting	
Height	105 mm
Width	61 mm
Depth	120 mm
Weight	315 g
Method of mounting	35 mm DIN rail mounting
IP Rating	IP20

## Ordering options

AMM Variant	Communications	Current inputs	Voltage inputs	FPI	Power measurements
AUT0004141	ETHERNET	3 x 1A / 5A	3 x 110 V AC	Yes	Yes
AUT0004267	ETHERNET	3 x 1A / 5A	6 x 4 V AC	Yes	Yes
AUT0007979	CAN	9 x 225 mV <sup>1</sup>	3 x 3.25 V AC <sup>2</sup>	No	Yes
AUT0008014 <sup>3</sup>	CAN	6 x 225 mV <sup>1</sup>	3 x 3.25 V AC <sup>2</sup>	No	Yes

Note:

1. For use with low power current transformers compliant with IEC61869-10
2. For use with low power voltage transformers compliant with IEC61869-11
3. AUT0008014 is the successor to AUT0004939

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