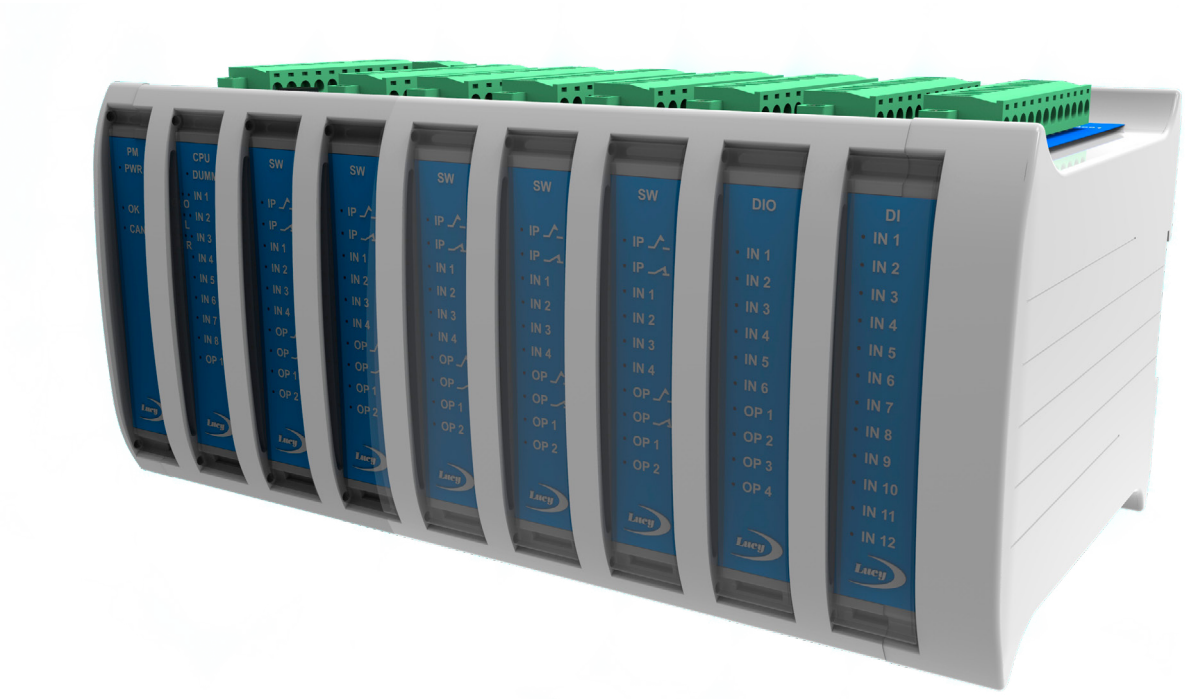
Lucy Electric

Gemini 4
Remote Terminal Unit



engineering intelligent solutions

Lucy Electric's complete range of automated power distribution products gives customers a choice of automation building blocks which can be tailored to offer a complete smart grid solution.

At the cutting edge of medium voltage switchgear design for both ground and pole-mounted switchgear, the products offer an innovative systems-engineered approach to smart grid solutions.

Introduction to Gemini 4 RTU

The Gemini 4 RTU is part of the Gemini Platform providing advanced monitoring and control for medium voltage switchgear. Switch control is achieved locally with the HMI module (common to the Gemini family), via hard-wired inputs, or remotely over a communication link.

The Gemini 4 RTU is DIN rail mounted providing the optimum suitability and footprint for controlling overhead and ground mount switchgear. The Gemini 4 RTU comprises up to seven factory fitted sub-assemblies which can control up to seven switches. This can be expanded up to 28 switch control with the addition of Gemini 4 Expansion Units

Features and benefits:

- Low power consumption saving costs in power supplies
- Dedicated motor power enable relay output providing safe and secure operation of switchgear
- Secure control operations using dedicated signals
- User configurable inputs and outputs, optional HMI via CAN bus port
- I/O expansion via CAN bus expansion port
- I/O expansion and analogue inputs via Modbus port
- I/O have associated LED indicators
- Digital inputs capable of using volt-free contacts avoiding need for providing a wetting voltage
- Capabilities for battery back-up supported
- Flexible communication options
  - IEC 60870-5-101 and IEC 60870-5-104
  - DNP 3.0
  - Modbus
  - Multiple masters
- Web browser interface for configuration
- Enhanced cyber security features for use in Critical National Infrastructure
- Secure firmware and configurable SMS reset function
- Simple DIN rail mounting, saving time and simplifying maintenance
- Optimised form factor providing efficient assembly into control cabinets and switchgear panels
- Easy to configure, customisable product adapting to different solutions
- Pluggable terminal blocks improving installation times
- IEC 61499 programmable logic
  - Event driven
  - Hierarchical
  - Distributed processing
  - Standard library functions available
  - IEC 61131-3 supported
- Pre-assigned I/O allocation available for fast and easy solutions
- Simple parameter changes in configuration tool allowing customisation

Gemini 4 functions

- SW sub-assembly – specific control logic for safe and secure operation of switchgear
- DI sub-assembly - 12 isolated user-configurable digital inputs
- DIO sub-assembly - 6 isolated user-configurable digital inputs and 4 isolated user-configurable digital outputs
- Expansion Unit (EU) - accommodating up to 3 more sub-assemblies (SW, DIO, DI). A total of 7 Expansion Units can be added.

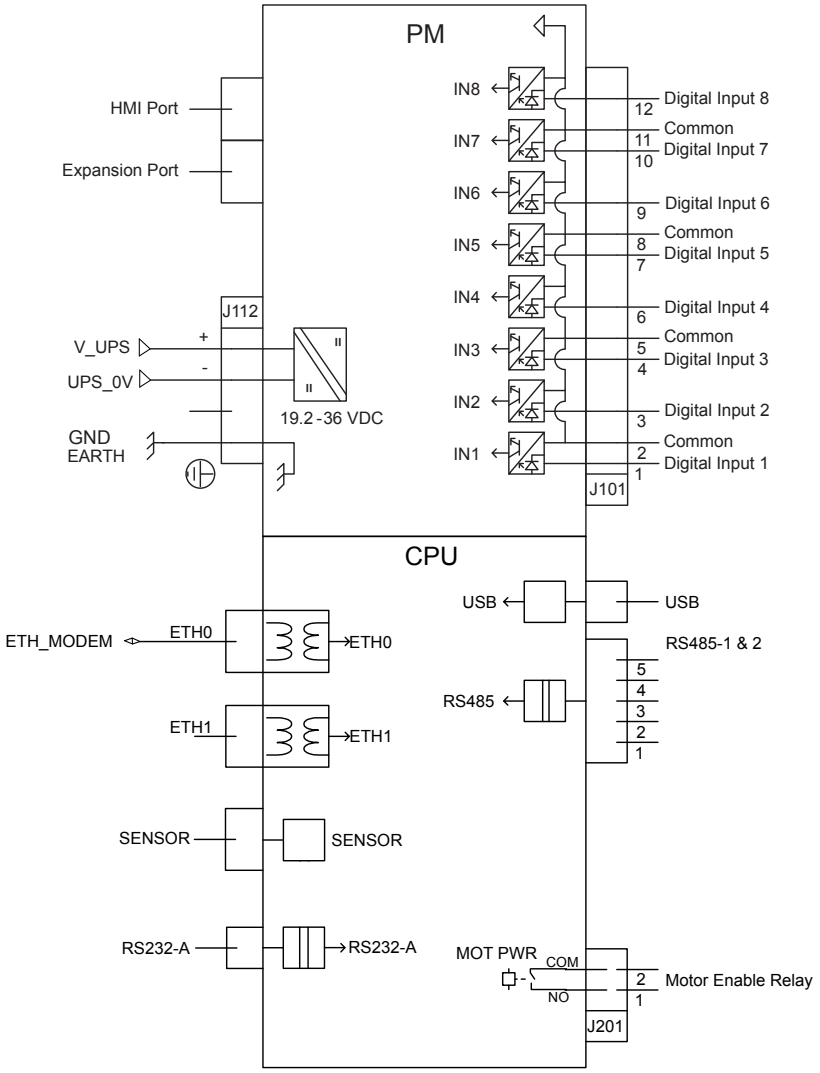
Gemini 4 applications

- Overhead switch monitoring and control
- Ring main unit monitoring and control
- Automatic transfer of source (ATS) schemes
- Automatic sectionalising
- Self-healing network applications

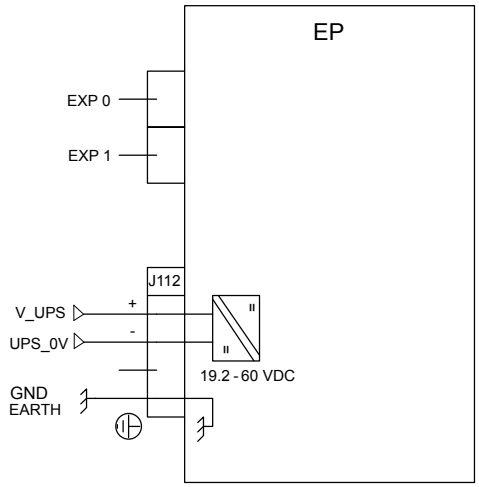
Gemini 4 overview

The Gemini 4 RTU comprises up to 7 sub-assemblies, each sub-assembly being Switch (SW), Digital Input / Output (DIO) or Digital Input (DI). Additional I/O can be added to the RTU with Expansion Units . Each Expansion Unit can comprise up to 3 sub-assemblies.

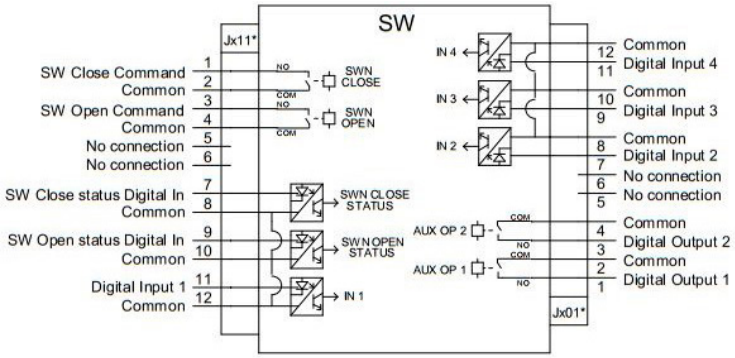
Power Management and CPU sub-assembly



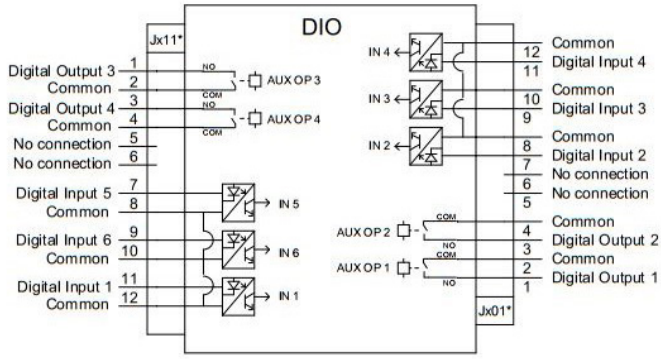
Expansion processor



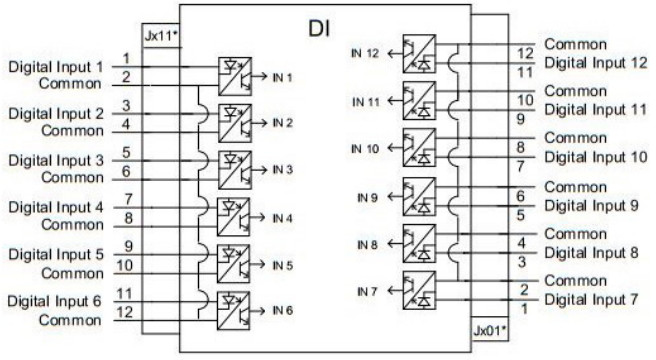
Switch sub-assembly



Digital input/ output sub-assembly

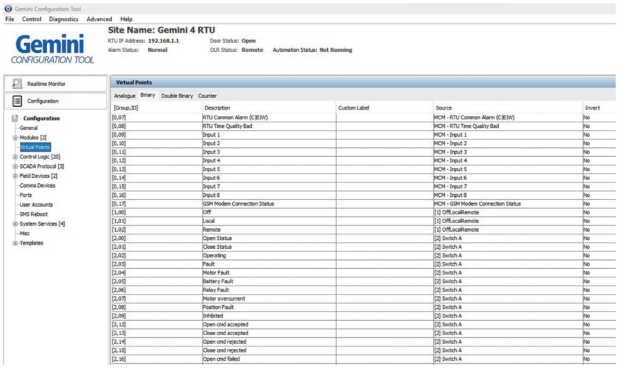


Digital input sub-assembly



Gemini 4 RTU overview

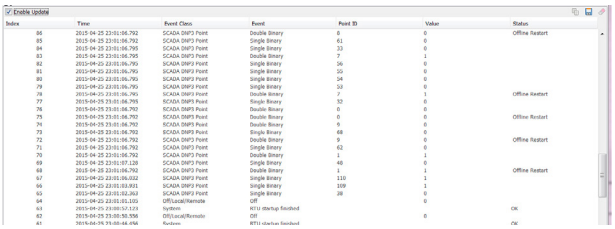
Digital Inputs



All control digital inputs are galvanic isolated using an optical coupler, and user-configurable (assignable, can be inverted, de-bounce timer) using the Gemini configuration and commissioning tool. An isolated 12 V wetting voltage is provided internally to power the optically-isolated digital inputs from external volt-free contacts. All digital inputs have associated LEDs to indicate input status.

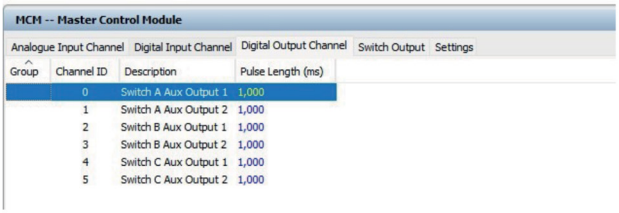
Alarms and Events

14,000 events (1 ms resolution) are stored in non-volatile memory. Alarms and event logs are available locally (via the optional HMI) or remotely via the SCADA communications. Alarms and event logs are also available via the Gemini configuration and commissioning software. Gemini 4 has a real-time clock with synchronisation available via NTP, GPS and the SCADA protocol.



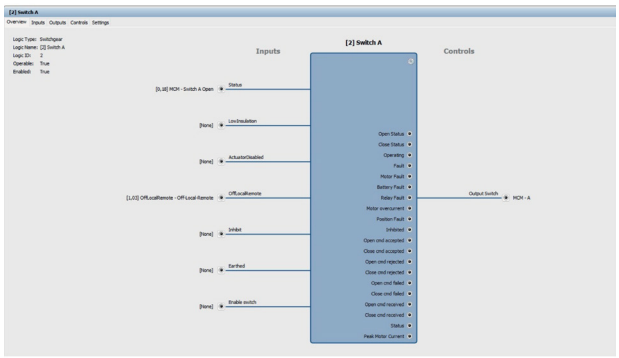
Digital Outputs

RTU output contacts are user-configurable (assignable, pulse length) using the Gemini configuration and commissioning tool. All output contacts are volt-free, rated at 30 VDC, with 1 A fuse protection, and isolated from the RTU electronics. This control can be operated from the Gemini configuration and commissioning tool, local HMI or from the SCADA. The status of all outputs is indicated by LED.



Automation Schemes

The Gemini 4 RTU supports IEC 61499 programmable logic. This is an event driven, hierarchical programming language, based on Function Blocks supporting centralised and distributed processing of fault detection, isolation and restoration. Standard library functions are available such as automatic source change-over and automatic sectionalising schemes.



Gemini 4 RTU overview

Gemini 4 RTU

The Gemini 4 RTU comprises a Power Module, CPU sub-assembly, and up the seven SW, DI or DIO sub-assemblies. Additional I/O can be added using Expansion Units.

Power management & CPU sub-assembly

The Power Module and CPU sub-assemblies form the Gemini 4 RTU; providing central control and supervision for all sub-assemblies and handling of the protocol communications. This is the minimum configuration of the Gemini 4 RTU providing 8 digital inputs and 1 digital output. When combined with SW sub-assemblies this digital output becomes a dedicated motor power control output with LED indication to enable the motor supply, thereby ensuring a safe and secure operation. There is also a special control indication (dummy control) which illuminates an LED to prove that the communication system is working.

SW sub-assembly

The Switch sub-assembly (SW) has 6 digital inputs and 4 digital outputs. Two sets of inputs and outputs are dedicated for switch control and not freely configurable by the user. These have been specifically pre-assigned and combined with control logic for safe and secure operation of switchgear.

DI sub-assembly

The Digital Input sub-assembly (DI) comprises of 12 isolated digital inputs. These inputs are all user-configurable.

DIO sub-assembly

The Digital Input / Output sub-assembly (DIO) is a variant of Switch sub-assembly (SW) wherein all I/O are freely configurable by user. This provides 6 freely configurable digital inputs and 4 freely configurable digital outputs.

Expansion unit

The Expansion Unit comprises an Expansion Processor (EP) accommodating up to 3 more sub-assemblies (DI, DIO, SW). A total of 7 Expansion Units can be added

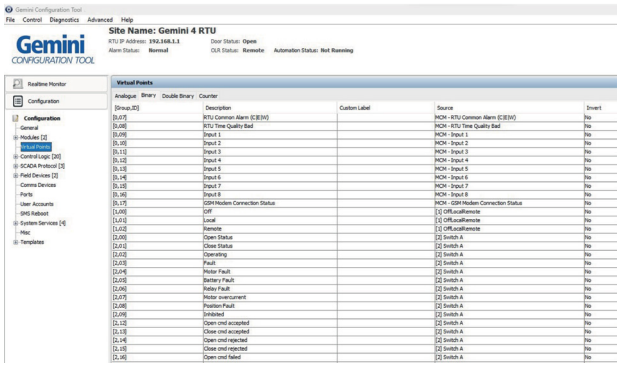
Gemini AMM

The Analogue Input Module (AMM) is part of the Gemini platform; it provides advanced measurement and directional fault detection. More details are available in the Gemini AMM data sheet.

Gemini 4 RTU overview

Configuration and commissioning

The Gemini configuration and commissioning tool is aimed to minimise training and also supports configuration and commissioning wizards.



Security compliance

The Gemini 4 RTU has been designed to be a secure element of a distribution automation system and has undergone extensive security testing, both in house and with external organisations. The Gemini 4 RTU uses a number of techniques to eliminate security vulnerabilities including:

- Stateful packet inspection firewall
- Service and port restriction
- Multi-layered access controls
- Role based authentication and authorisation

We are constantly reviewing product security and keep a close watch on new threats and attack vectors. As appropriate Lucy Electric will respond to identified risks and enhance the security of our products.

Power supply requirements

The Power Module and Expansion Processor can be powered from a stable DC supply in the range 19.2 - 36 VDC. The consumption will be 6, 10 or 15 W depending on the number of sub-assemblies. The RTU provides a dedicated output which can enable a motor power relay, providing an additional interlock for secure operation of electrical plant.

HMI, communications and communication protocols

The following communications ports are provided:

- Dual isolated Ethernet ports, for TCP / IP and VPN connections
- Isolated RS232 port, for serial data transmission, 9 Pin D Type connector
- Dual isolated RS485 port, for serial data transmission
- USB port (optional)
- CAN bus port for Gemini HMI
- CAN bus port for future expansion
- Temperature sensor input via I2C (range -40˚C to +150˚C)

Gemini 4 RTU overview

HMI, Communications and Communication Protocols

The Gemini 4 supports the standard HMI common to the Gemini platform. The HMI is an optional module that allows local control and monitoring of the Gemini 4 RTU without the need for the Gemini configuration and commissioning tool or SCADA.

Slave: DNP 3.0 serial and TCP, IEC 60870-5-101, IEC 60870-5-104. This is for SCADA communications, and multiple masters are supported.

CAN bus

Local / Remote Indication

Three operation modes are available; control capability off, local and remote. The status of these operating modes is indicated by LEDs, and can be communicated to the SCADA. These operating modes can be switched using the Gemini HMI option. Binary inputs can also be configured to provide off /local/ remote as an alternative to the HMI.

Master: Modbus RTU and TCP. This is for integrating IED slave devices such as power meters and protection relays into the Gemini 4 RTU and can be presented to the SCADA. DNP 3.0 master is also available.

Inputs, Outputs and LED Indications

	RTU	SW	DIO	DI	EP
LED's	Power RTU OK CAN bus OK Dummy Switch OFF/Local/Remote				Power EU Module OK CAN bus OK
Inputs/ LED's	Input 1 Input 2 Input 3 Input 4 Input 5 Input 6 Input 7 Input 8	Switch Open input Switch Closed input Input 1 Input 2 Input 3 Input 4	Input 1 Input 2 Input 3 Input 4 Input 5 Input 6	Input 1 Input 2 Input 3 Input 4 Input 5 Input 6 Input 7 Input 8 Input 9 Input 10 Input 11 Input 12	
Outputs/ LED's	Motor enable relay	Switch open command Switch close command Output 1 Output 2	Output 1 Output 2 Output 3 Output 4		
Connectors					
Inputs/ outputs	1 x 12-pin pluggable connector 12 AWG	2 x 12-pin pluggable connectors 12 AWG	2 x 12-pin pluggable connectors 12 AWG	2 x 12-pin pluggable connectors 12 AWG	
Power Supply	1 x 4-pin pluggable connector 12 AWG				1 x 4-pin pluggable connector 12 AWG
CAN Bus	2 x RJ12 connectors				2x RJ12 connectors
Motor enable	1 x 2-pin pluggable connectors				
RS 485	2 x 5-pin pluggable connectors				
Ethernet	2 x RJ45 connectors				
RS 232	1 x 9-pin DB9				
USB	1 x USB				
Sensor input	I2C input (for measuring temperature and humidity)				

Dimensions and Mounting

Gemini 4 RTU

	0-switch	1-switch	2-switch	3-switch
Height	106.0 mm	106.0 mm	106.0 mm	106.0 mm
Width	59.6 mm	84.2 mm	108.8 mm	133.4 mm
Depth	120.0 mm	120.0 mm	120.0 mm	120.0 mm
Method of mounting	35 mm DIN rail mounting			
IP Rating	IP20			

	4-switch	5-switch	6-switch	7-switch
Height	106.0 mm	106.0 mm	106.0 mm	106.0 mm
Width	158.0 mm	182.6 mm	207.2mm	231.8mm
Depth	120.0 mm	120.0 mm	120.0 mm	120.0 mm
Method of mounting	35 mm DIN rail mounting			
IP Rating	IP20			

Gemini 4 Expansion Processor

	1-switch	2-switch	3-switch
Height	106.0 mm	106.0 mm	106.0 mm
Width	59.6 mm	84.2 mm	108.8 mm
Depth	120.0 mm	120.0 mm	120.0 mm
Method of mounting	35 mm DIN rail mounting		
IP Rating	IP20		

Technical Data

Atmospheric Environment

Test	Standard	Description
Cold test operation	IEC 60068-2-1	-25°C for 96 hours
Cold test storage	IEC 60068-2-1	-40°C ±2°C for 16 hours
Dry heat test storage	IEC 60068-2-2	+85°C ±2°C for 16 hours
Dry heat test operation	IEC 60068-2-2	+70°C ±2°C for 96 hours
Cyclic temperature	IEC 60068-2-14	-25°C, +70˚C, 5 cycles, dwell time 3 hours
Damp heat steady state	IEC 60068-2-78	+40 °C, 93% RH, 10 days
Cyclic temperature with humidity	IEC 60068-2-30	6 of 24 h (12 h + 12 h) cycles 93 % RH at +55°C and 97% RH at +25°C
Ingress protection	IEC20255-27 and IEC60529	IP 20 RTU Electronics

Mechanical Environment

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

Electrical Environment

Test	Standard	Description
Insulation – dielectric	IEC 60255-27	Power supply port, input/output ports, earth port, 2kV, 1 minute For comm. ports 0.5kV, 1 minute
Insulation – impulse voltage	IEC 60255-27	Power supply port, input/output ports, earth port, 5 kV peak, 1.2/50 µs, 0.5 J For comm. ports, 1kV peak, 1.2/50 µs, 0.5 J
Insulation - insulation resistance	IEC 60255-27	Power supply port, input/output ports, earth port and communication ports > 100 MΩ at 500 V d.c.

EMC Tests

Test	Standard	Description
Electrostatic discharge immunity	IEC 60255-26, IEC 61000-4-2	Level 3
Radiated, radio-frequency, electromagnetic field immunity	IEC 60255-26, IEC 61000-4-3	Level 3
Fast transient immunity	IEC 60255-26, IEC 61000-4-4	Level 4
Surge immunity	IEC 60255-26, IEC 61000-4-5	Level 4
Conducted disturbance induced by RF fields	IEC 60255-26, IEC 61000-4-6	Level 3
Power frequency magnetic field immunity	IEC 60255-26, IEC 61000-4-8	Level 4
Pulse magnetic field immunity	IEC 61000-4-9	Level 5
Damped oscillatory magnetic field immunity	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
DC interruption test	IEC 60255-26, IEC 60255-4-29	Class test level 0 % residual voltage
Power Frequency Immunity	IEC 60255-26, IEC 60255-4-16	Class A test on dc binary inputs

Detailed reports can be made available upon request.

Ordering Options

Gemini 4 RTU

Gemini 4 RTU	G4	1							
Power Supply									
24 V dc +/- 20%									
Product configuration (select from options below*)									
Sub-assembly type at Slot 1			x						
Sub-assembly type at Slot 2				x					
Sub-assembly type at Slot 3					x				
Sub-assembly type at Slot 4						x			
Sub-assembly type at Slot 5							x		
Sub-assembly type at Slot 6								x	
Sub-assembly type at Slot 7									x
HMI interface									
Extended memory									
USB Port									
Accessories									
HMI									
HMI cable									

*Sub-assembly type	
Sub-assembly (status 4 DI & 2 DO, control 2 DO & DI)	A
DIO SW sub-assembly (6 DI, 4 DO)	B
DI sub-assembly (12 DI)	C
No sub-assembly	X

Left to right order priority: SW, DIO, DI

Gemini 4 Expansion Unit

Gemini 4 Expansion Unit	EU	1			
Power Supply					
24 V dc +/- 20%					
Product configuration (select from options below)**					
Sub-assembly type at Slot 1			x		
Sub-assembly type at Slot 2				x	
Sub-assembly type at Slot 3					x
Accessories					
Cable for connecting expansion unit					

**Sub-assembly type	
Sub-assembly (status 4 DI & 2 DO, control 2 DO & DI	A
DIO SW sub-assembly (6 DI, 4 DO)	B
DI sub-assembly (21 DI)	C
No sub-assembly	X
Left to right order priority: SW, DIO, DI	

Gemini 4 accessories

Order code	Description
AUT0000037	Gemini HMI
AUT0003408	Gemini 4 HMI cable
AMM	See AMM data sheet
AUT0003902	Temperature sensor

For complete RTU solutions please contact your local sales representative

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