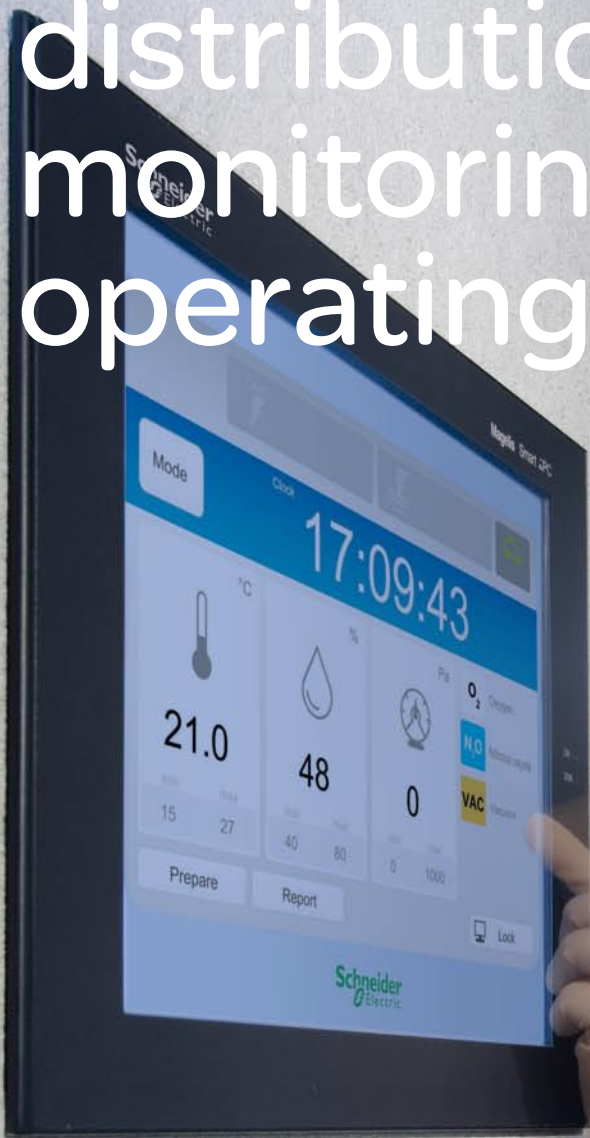


# Secure power distribution and monitoring solution for operating theatres



Solution guide

# Ensuring the continuity of healthcare in all circumstances

Operating rooms require impeccable availability and quality of electric power to offer to patients a maximum of safety. For this reason, the standards lay down very strict rules to ensure the continuity of service of electrical installations.



## IEC

**Our solution  
complies with  
international standard  
IEC 60364-7-710  
and national standards  
and regulations**

### What do the standards say?

- > In group 2\* rooms for medical use, **the medical IT system\*\*** should be used for the circuits powering medical electrical equipment and systems for survival and surgical applications, and the other equipment located in the environment of the patient.
- > An **audible and visual alarm** must be provided for in the room in question to alert medical personnel.
- > Operating activities must have **continuity of electric power supply**.
- > For the satisfactory operation of medical equipment, **prevention of electromagnetic disturbances** may be necessary.



\* Group 2 (according to IEC 60364-7-710): rooms for medical applications in which the parts applied are designed to be used in applications such as intracardiac procedures, operative fields and vital treatments where discontinuity (failure) of the power supply could entail danger for life.

\*\* The medical IT system does not require automatic cutoff of the power supply whenever an insulation fault occurs. In this type of system, the exposed conductive parts of the installation are connected to the installation's neutral point.

# A reliable, efficient manufacturer's solution

A global specialist in energy management, Schneider Electric offers an innovative secure power distribution and monitoring solution for operating theatres, in conformity with the IEC 60364-7-710 standard.

## A manufacturer's solution...

- > All the components of this solution are **designed, manufactured and tested by Schneider Electric** to operate together and be implemented by trained and approved partners.
- > Schneider Electric proposes **maintenance plans** and **operating procedures** linked to this solution.
- > Schneider Electric ensures the **continuity of the components** throughout the installation's life.

## ... from secure power distribution...

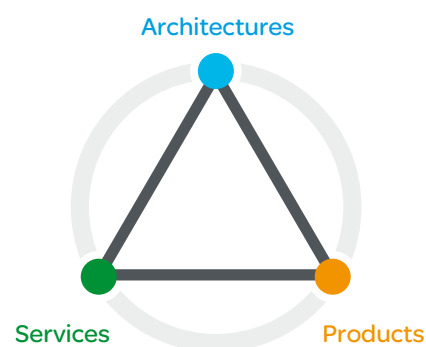
- > The Schneider Electric solution incorporates an isolating transformer and an insulation monitoring device in conformity with the required standards to ensure the power supply for medical equipment on first insulation fault.
- > The continuity of the electric power supply is ensured thanks to total coordination of all the Schneider Electric components and the uninterruptible power supply.
- > The Schneider Electric solution is designed, wired and tested to attenuate electromagnetic disturbances in accordance with the IEC 60364-4-44 standard.

## ... to event monitoring and traceability

The Schneider Electric solution incorporates a monitoring system to:

- > Inform maintenance personnel and medical personnel in real time in the event of an electrical fault,
- > Monitor the operating room environment,
- > Record environmental events and data.

The design of our solution for operating theatres is the result of a comprehensive approach to improving the reliability of hospital power distribution.



### Architectures

designed to ensure the availability of electricity distribution according to the various criticality levels.

### Products

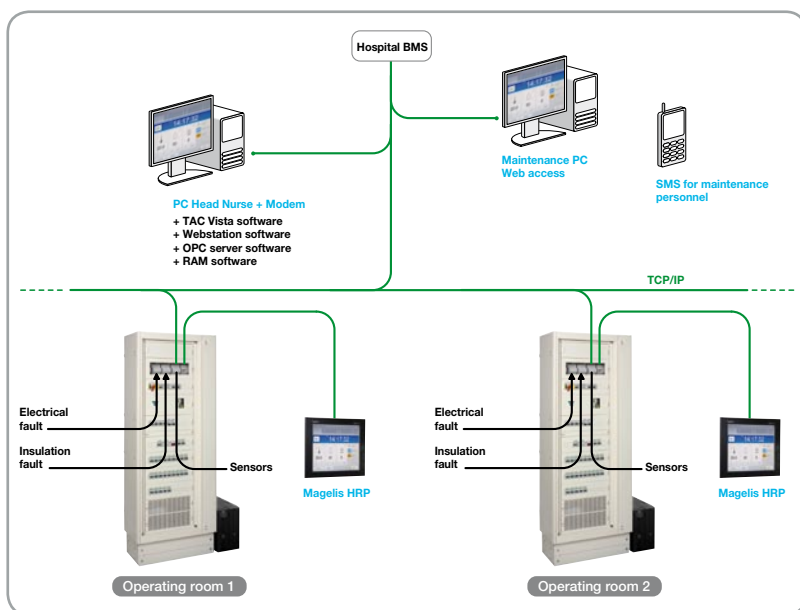
selected and installed to state-of-the-art standards, in perfect conformity with the architectures.

Efficient **services** throughout the operation and life cycle of your installation.

# A monitoring system...

Reliable information is needed to manage the satisfactory operation of operating theatres. The monitoring system informs in real time and allows taking the appropriate decisions in case of unexpected events.

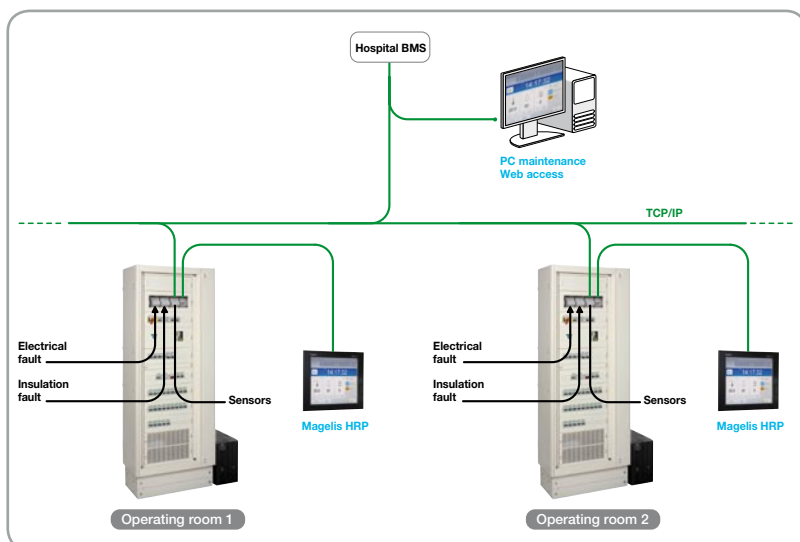
## > Monitoring system for the “Full” solution



This monitoring system makes it possible:

- > With the Magelis touch screen panel in the operating room, to have information concerning alarms generated by the electrical installation and concerning the operating room environment.
- > With the monitoring system softwares, to have real-time access to all information concerning operation of the operating rooms and to ensure event traceability.

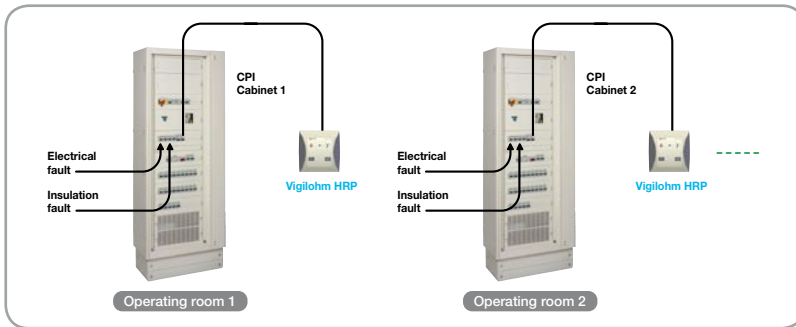
## > Monitoring system for the “Advanced” solution



The monitoring system makes it possible:

- > With the Magelis touch screen panel in the operating room, to have information concerning alarms generated by the electrical installation and concerning the operating room environment.
- > With Internet Explorer, to have real-time access to all information concerning the operation of each operating room.

## > Monitoring system for the “Classic” solution



This monitoring system makes it possible, with the Vigilohm HRP in the operating room, to have information concerning the alarms generated by the electrical installation.

# Three levels of information

Solution

Full

Advanced

Classic

Functions performed by the control and signalling panel in operating theatre

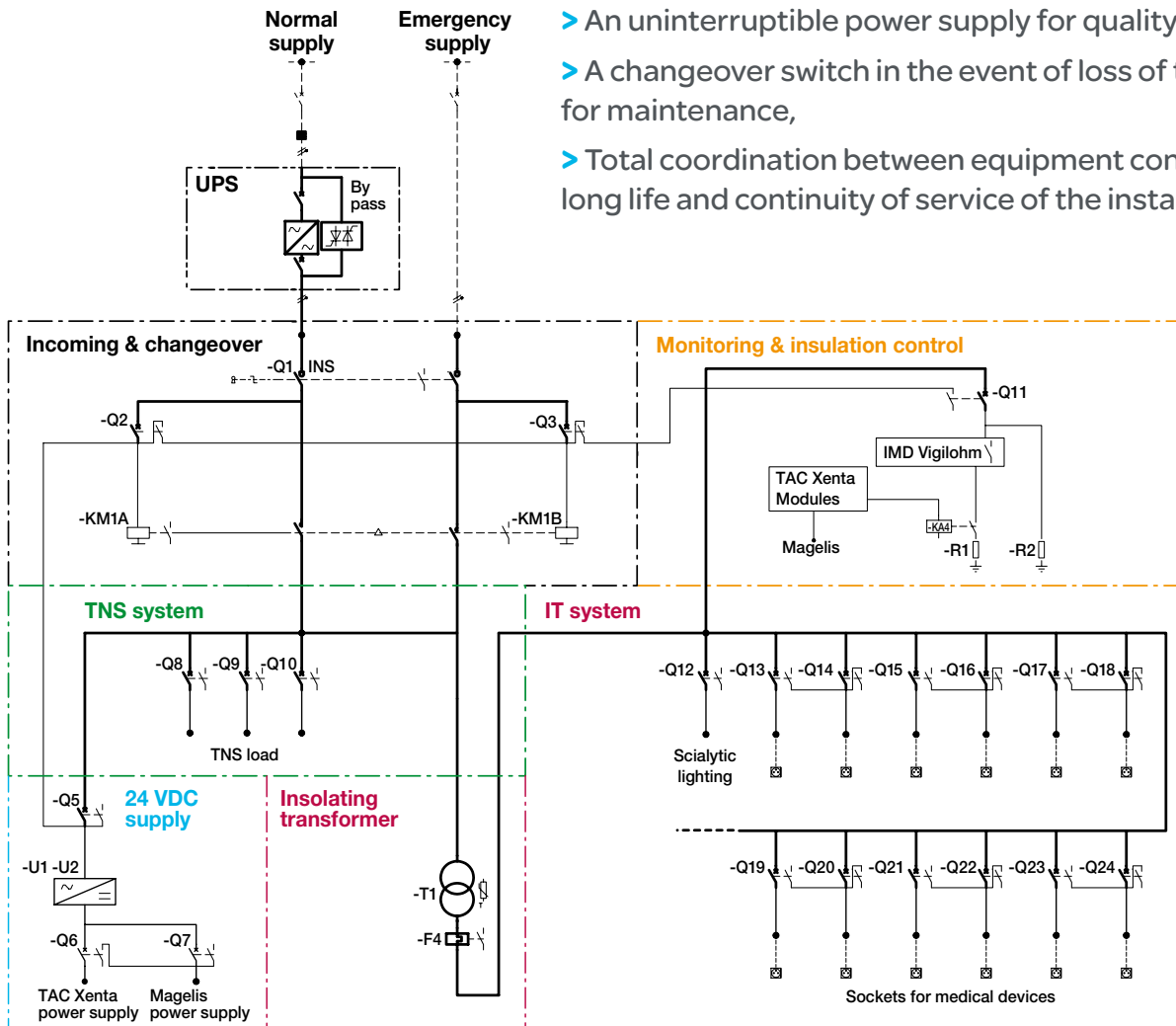
Type of Control and signalling panel in operating room	Magelis HRP	Magelis HRP	Vigilohm HRP
Visual and audible alarms on electrical and insulation faults	●	●	●
Audible alarm stoppage	●	●	●
Tests of the insulation monitoring system	●	●	●
Fault handling information	●	●	
Time display, chronometer and timer	●	●	
Display of operating room temperature, relative humidity and pressure	●	●	
Display of medical gas states (O <sub>2</sub> , N <sub>2</sub> O, vacuum)	●	●	
Temperature and relative humidity value setting	●	●	
Generation of an event report	●		

Functions performed by the monitoring system

<b>Access to functions by supervision personnel</b>	●		
<b>Access to functions by maintenance personnel</b>	●	● (by web)	
<b>Simultaneous display of all operating rooms data</b>			
temperature, relative humidity and pressure	●		
medical gas states	●		
electrical and insulation fault alarms	●		
<b>Display of each operating room data</b>			
temperature, relative humidity and pressure	●	●	
medical gas states	●	●	
electrical and insulation fault alarms	●	●	
list of events with dates	●	●	
display of current alarms	●	●	
min and max threshold alarms for temperature and relative humidity settings	●	●	
display of temperature, pressure and relative humidity curves	●		
event report edition (Excel file export can be possible)	●		
Sending of an SMS to maintenance personnel in the event of an electrical installation fault (operating room number + type of alarm)	●		
“Fault handling” information from the maintenance personnel	●	●	
Hospital Building Management System connection	●	●	

# 1 coherent electrical system architecture dedicated to continuity of service

- > An uninterruptible power supply for quality of power,
- > A changeover switch in the event of loss of the UPS and for maintenance,
- > Total coordination between equipment contributes to long life and continuity of service of the installation.



- Electrical system architecture consistent with equipment and a distribution system from a single manufacturer
- Interoperability with the hospital's electrical system architecture thanks to Schneider Electric equipment

# Two switchboard sizes

Depending on the space available, you can opt for a switchboard with or without an integrated transformer.

## Overall dimensions

### Prisma Plus P cabinet

Height	Width	Depth	Weight
2206 mm	856 mm	450 mm	290 kg

### Prisma Plus G cabinet with separate transformer

Height	Width	Depth	Weight
1830 mm	900 mm	243 mm	150 kg

### Magelis HRP touch screen panel

Height	Width	Depth	Weight
294 mm	395 mm	65 mm	6 kg
<b>Cross section (WxH):</b>		383,5 x 282,5 mm	

### Vigilohm HRP

Height	Width	Depth	Weight
170 mm	170 mm	20 mm	0,5 kg



### Transformers with IP 21 /IK07 cover

Power	Height	Width	Depth	Weight
6,3 kVA	710 mm	470 mm	540 mm	85 kg
8 kVA	710 mm	470 mm	540 mm	95 kg
10 kVA	740 mm	470 mm	540 mm	100 kg

### Smart UPS-RT uninterruptible power supply

Power	Height	Width	Depth	Weight
8/10 kVA	432 mm	263 mm	736 mm	111 kg



## EMC

Conformity with the IEC 60364-4-44, 61000-6-2 and 6-3 standards thanks to the low level of equipment emissivity and sensitivity, and the cabling rules applied

# How to choose the right solution?

Our solution adapts to all situations and all specifications...

## Selection in 5 steps:

**1** Operating theatre monitoring system for one of the following solutions

- Full
- Advanced
- Classic

**2** Dimensional constraints

- Cubicle with integral transformer (HxWxD): 2206 x 856 x 450 mm
- Cabinet (HxWxD): 1830 x 900 x 243 mm with IP21/IK07 separate transformer (HxWxD): 740 x 470 x 540 mm

**3** Transformer power

- 6,3 kVA
- 8 kVA
- 10 kVA

**4** Number of feeders\* in IT system

1 to 24

Number of feeders\* in TNS system

1 to 6

**5** UPS

- Yes       No

If yes, power:

- 8 kVA       10 kVA

\* 1 or 3 power outlets per feeder



# Technical characteristics

## Electrical characteristics

Operational voltage: 230V / 50-60 hz

Isc: 25 kA

In: 63 A maximum

## Environmental conditions

(Operating room or electrical premise)

Location	indoor
Altitude	< or = 2 000 m
Maximum ambient air temperature	30°C
Relative humidity	90%
Switchboard power losses	465 W

## Electrical switchboard enclosure: Prisma Plus

Steel sheet, Cataphoresis treatment + hot-polymerized polyester epoxy powder, RAL 9001 colour

Degree of protection	IP30
Degree of protection against mechanical shocks	IK07
Ventilation	Natural ventilation
Cable inlets and outlets	In duct, through the bottom or top
Cable connection	To terminals

## IT system feeders

Isolating transformer	6.3/8 or 10 kVA with temperature sensor and overload monitoring
EM9BV continuous insulation monitor + display of insulation value	- Internal resistance in alternating current: 100 kΩ - Injection voltage: 24 VDC max. - Injected current: 240 µA dc max. - Fault indication threshold setting: 50 kΩ.
C curve C60N circuit breakers	Up to 24 feeders on 3 rows (protection for 1 or 3 power outlets per feeder)

## TNS system feeders

C curve C60L circuit breakers	Up to 6 feeders
-------------------------------	-----------------

## Monitoring

Data acquisition and communication modules	TAC Xenta 731, 421, 321
Protocols	LonWorks, LonMark, Modbus and TCP/IP
Temperature, pressure and relative humidity sensors	Schneider Electric
Data backup time	1 hour
Magelis touch screen panel	15" backlit active-matrix TFT LCD tested with Anios products
Vigilohm HRP	Plastic case: IP54, IK10 tested with Anios products

## Conformity with standards

Switchboard	IEC 60364-7-710 IEC 61439-1 and -2
Isolating transformer	IEC 61558-2-15
Continuous insulation monitor	IEC 61557-8
Electromagnetic compatibility	IEC 60364-4-44 IEC 61000-6-2 and -3

## Uninterruptible power supply

Efficiency at full load	98 %
Output voltage distortion	< 3 %
Standard duration of power supply at full load	5 mn

# > Vigilohm EM9BV insulation monitor device

The EM9BV insulation monitor device is assigned to monitoring of low-voltage AC networks with isolated neutral or directly earthed neutral via a capacitive impedance.

### > Measuring and indicating insulation faults

The EM9BV continuous insulation monitor complies with the standards for use in medical locations: IEC 60364-7-710 and EN 61557-8.

Required by IEC 60364-7-710	EM9BV
Impedance > or = 100 kΩ	100 kΩ
Test voltage value < or = 25 VDC	24 VDC
Maximum current injected < or = 1 mA	240 μA
Fault signaling threshold < or = 50 kΩ	50 kΩ (sealable threshold)

### > Operation

- Continuous insulation monitors inject a direct voltage into the network, thus creating an “artificial” leakage current.
- An electronic device measures the network insulation from this current.
- When this insulation level is below the user-selected threshold, a relay switches and the fault indicator lamp lights.
- The EM9BV is a failsafe device, the output relay is excited permanently, and de-excited in the event of an auxiliary voltage failure or an insulation fault.
- Constant digital display of insulation resistance on a screen.



Type of network to be monitored:  
LV AC IT systems

Phase-to-phase voltage with EM9BV connected to neutral	< 760 V
Frequency	50-60Hz

### Characteristics

Ohmmètre	Type	Digital
	Range	0 to 511 kΩ
Impedance		100 kΩ
Maximum current injected		240 μA
Fault indication	Number of thresholds	1 (sealable)
Response time		< 5 s
Operating test		Local
Thermal resistance in operation		- 5 °C to + 55 °C
Auxiliary supply voltage		115/127 VAC 50/60 Hz
		220/240 VAC 50/60 Hz



# Single-phase isolating transformers for medical locations

Medical locations and operating theatres in particular are environments in which patient safety and the quality and continuity of power are of prime importance.

> **Schneider Electric offers a range of isolating transformers** for electrical circuits subject to the IT system and in compliance with the IEC 60364-7-710 and IEC 61558-2-15 standards.

> **For use in medical locations**, short-circuit protection is not acceptable and the transformer must be able to withstand overloads. Whenever the internal temperature and overload current thresholds recommended by Schneider Electric are exceeded, alarms are generated.

> **The patient's safety** is ensured by reinforced insulation and a low leakage current which reduce the risk of electric shock and prevent unwanted currents which could disturb sensitive medical instruments.

> **The quality and continuity of power** are ensured through technical features which can limit nuisance tripping of protection systems and provide a stable electric power supply for medical equipment.

> **The manufacturing arrangements** adopted of course imply fewer losses and generate less heat, with no ventilation of the electrical cabinet, no noise and no routine cleaning.



## Technical characteristics

Special dry single-phase LV/LV transformers:	6.3/8 or 10 kVA
Voltage ratio:	230/115-230 V
Frequency:	50/60 Hz
Insulation level:	1,1 kV
Insulation class:	H
Temperature rise class:	F
Short circuit voltage:	< 3 %
Magnetizing current:	< 3 %
Inrush current:	< 12 In
Leakage current between enclosure and frame:	< 0.5 mA
Leakage current between secondary and frame:	< 0.5 mA
Earthing system:	IT
Supplied with or without IP21/IK07 cover, and 1 individual test report	



- Reinforced insulation
- Low leakage current
- No ventilation

# > TAC Xenta communication module

The TAC Xenta modules meet present and future open architecture requirements for building control. They are based on the LonMark LonWorks, Modbus and TCP/IP standards.

- > Functions in the medical solution**
- Transmission of electrical faults, information from sensors (temperature, pressure, relative humidity) and state of medical gases to the Magelis screen in the operating room and to the PCs of supervision and maintenance personnel,
  - Management of Web pages to Magelis and supervision and maintenance PC,
  - Saved data backup period: 72 hours.

- > General characteristics**
- The TAC Xenta modules consist of an electronic part and a terminals part assembled together,
  - All wiring is performed on the terminals part only, thus allowing the electronic part to be removed without altering the wiring,
  - 24 VDC power supply,
  - ABS/plastic module housing ,
  - Degree of protection: IP20 (Xenta 411: IP10).

- > References**
- Controller and Web server: Xenta 731,  
 Logical input module: Xenta 411,  
 Digital inputs/outputs module: Xenta 421.



**Technical characteristics of Xenta 411**

10 logical inputs	
Voltage across terminals of open contact	26 VDC
Current in closed contact	4 mA
Min. pulse duration	20 ms

- +**
- Compliance with EMC standards: IEC 61000-6-1, 2 and 3, IEC 61010-1, for the 3 modules
  - Connection to the Hospital Building Management System (BMS) via the TCP/IP Ethernet network

**Technical characteristics of Xenta 421**

4 universal inputs (digital, thermistors, current or voltage)	
<b>Digital inputs</b>	
Voltage at open contact level	20 VDC
Current at closed contact level	3 mA
Pulse duration	20 ms min.
<b>Current inputs</b>	
Input signal	0-20 mA
Input resistance	47 ohms (inaccuracy of ± 0.03 mA + 0.4% reading)
<b>Voltage inputs</b>	
Input signal	0-10 VDC
Input resistance	>100 kohms (inaccuracy of ± 7 mV + 0.2% reading)
<b>Thermistor inputs</b>	
TAC temperature sensor	1 800 ohms to 25°C
Measuring range	from 50 to 150°C
5 digital outputs	
Control voltage, relay outputs	250 Vac
Control current	2 A maxi

**Technical characteristics of Xenta 731**

<b>Real-time clock</b>	
Accuracy	at +25 °C ±12 minutes per year
Data backup in event of power failure:	72 h
<b>Communication</b>	
RS232	2400-57600 bps, RJ45, 8-p
RS485	2400-57600 bps, async. term. block
RS232	RJ10, 4-p
RS485	sync. (SDLC) terminal block
LonWorks	TP/FT-10, terminal block
Ethernet	TCP/IP, 10 Base-T, RJ45

# > Control and signalling panel in operating room

## Magelis HRP for the “full” and “advanced” solutions

Very compact industrial PC, dedicated to Human-Machine Interface applications, hardened, with no components of limited reliability (hard disk, fans).

> **Magelis HRP is designed with components of industrial quality**

and robust materials:

- Built on a stainless steel frame, it has an aluminium alloy front panel with IP65 membrane,
- Very luminous and high-contrast, with a wide angle of view, the backlit TFT LCD screen is active-matrix type.

> **Embedded software:** Windows XP Pro Service Pack 2 + specific operating theatre application.

> **Display:**

- Electrical fault alarm,
- Insulation fault alarm,
- Time display hh/mm/ss,
- Display of fault handling by maintenance personnel,
- Temperature, pressure, relative humidity display,
- State of medical gases: oxygen (O<sub>2</sub>), nitrogen oxide (N<sub>2</sub>O) and vacuum.

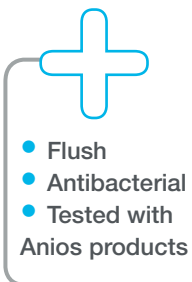
> **Settings:**

- Temperature and relative humidity values (available to the hospital's BMS),
- Screen locking,
- Start-up of chronometer or timer,
- Testing of insulation monitor,
- Day/night screen lighting,
- Generation of an event report.



### Technical characteristics

Reference	MPCST52NDJ20T
Touch-sensitive screen TFT 15" LCD	
Resolution	XGA 1024x768
Luminosity	>= 250 cd/m <sup>2</sup> , adjustable
Angle of view	Horizontal 160°, Vertical 160°
Port on front panel	1 x USB
Processor	Celeron M@600MHz
RAM	512 MB
Extension	2 x PCMCIA type I (or type III)
Ethernet ports	2 (10/100/1G + 10/100A)
I/O ports	4 x USB, 2 x RS 232
Alimentation	24 VDC backed-up (1 hour reserve)
Buzzer	External, on order



## Vigilohm HRP for the “Classic” solution



### Simple and efficient

- > Audible and visual alarm for an insulation or electrical fault (transformer overload or circuit breaker tripping),
- > Testing of the insulation monitoring system,
- > Audible alarm stoppage,
- > 24 VDC power supply.

# > Secure electrical distribution switchboards for operating theatres

Switchboards tested in accordance with IEC 60364-7-710 and IEC 61439-1 and -2 standards and the EMC standard IEC 60364-4-44.

> **2 enclosure solutions**

- Prisma Plus System P cubicle, integral isolating transformer,
- Prisma Plus System G floor standing enclosure, external isolating transformer in an IP21/IK07 cover.

> **Safety of personnel and the installation**

- Horizontal physical separation of zones by metallic screens (P and G systems),
- Vertical physical separation between the switchgear part and the cable duct (System P).

> **Immunity to electric fields through**

- Separation of weak current and heavy current cables,
- Low emissivity and sensitivity of equipment,
- Vertical and horizontal physical separations,
- Linking of exposed conductive parts.

> **Power distribution by** Multiclip 80A and Polybloc 160A distribution blocks with spring terminals.

> **Front side with pivoting plates,**

- plain or transparent:
- Pivoting for System P,
  - Removable in one piece for System G.

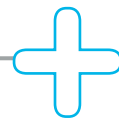
> **Natural ventilation**

> **Floor mounting at 4 points**



Prisma Plus System P

Prisma Plus System G + transformer IP21/IK07



- 2 enclosure solutions to meet the space requirements of electrical rooms
- Reliability of electrical connections thanks to distribution blocks with spring terminals, no maintenance
- High level of reliability of the electrical installation thanks to full compatibility between Schneider Electric equipment and distribution blocks

# > Smart-UPS RT uninterruptible power supply

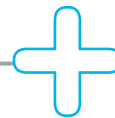
The Smart-UPS RT uninterruptible power supply protects the switchboard against mains power cuts, voltage dips and overvoltages.

> In the event of main supply failure, **the uninterruptible power supply ensures a continuous power supply** via its internal battery until the return to normal or until the battery is completely exhausted.

> **The uninterruptible power supply filters** slight current fluctuations and **isolates** the switchboard from major disturbances by disconnecting from mains.

## Technical characteristics of APC Smart UPS

Power supply output capacity	6400 W/8 kVA or 8000 W/10 kVA	
Nominal output voltage	230 V (configurable to 220, 230 or 240 V)	
Efficiency at full load	93%/8 kVA	92%/10 kVA
Output voltage distortion	< 3%	
Output frequency	50/60 Hz +/- 3 Hz adjustable by the user +/- 0.1	
Type of waveform	Sine	
Bypass	Internal bypass (automatic and manual)	
Battery type	4 maintenance-free lead and acid sealed batteries, with electrolyte in suspension	
Typical duration of standby power supply at half-load	15 minutes	
Standard duration of standby power supply at full load	5 minutes	



Quality of electric power supply and continuity of service

# High-value-added services

Throughout the world, our Schneider Electric Service experts and our local partners are attentive to your needs and propose to you a comprehensive and unique service offering.

## Expert services

For improved performance...

- > Energy efficiency,
- > Installation reliability and safety,
- > Reduced capital expenditure,
- > Reduced power consumption,
- > Reduction in the number of failures,
- > Reduction in downtime and repair time,
- > Training of operation and maintenance teams,
- > Longer equipment service life.

... Over the entire life cycle of the installation

- > Installation design,
- > Commissioning,
- > Operating aid,
- > Maintenance and revamping,
- > Energy efficiency audit,
- > Customized services.

## Customer support and online services

- > Call centres, online diagnosis services and technical assistance,
- > Services via Internet: electronic catalogues, downloadable software, information and training.

## In Search of Excellence

Schneider Electric conducts an ambitious innovation, quality and efficiency policy:

- > Around 5% of turnover is invested in R&D,
- > 6,500 researchers and developers.

## A close relationship with our customers

> A strong international footprint with 105,000 employees in 130 countries. With our partners, distributors, panelbuilders, contractors and engineering offices, we want to establish with you a relationship of trust and help you achieve an optimal level of performance.

## A strong social commitment

- > Sustainable development is key in Schneider Electric's strategy. Our solutions help those without electricity obtain access to it and favour a reduction in energy consumption.
- > 91% of our plants are certified ISO 14001. The Schneider Electric product offering complies with all existing standards worldwide.

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