3SWT

IEC-61850 Ethernet Switches Family for Electrical Substations

Industrial range managed Ethernet Switches for electrical substations. IEC-61850 certified for interoperation with any manufacturer IEDs

Certified for the stringent levels of high and medium voltage electrical substation environments.

Flexibility in number and type of ports (copper/fiber, 10/100/1000 Mbps, PoE).

Direct integration with any other IEC-61850 device.

Easy to use user interfaces for switch features configuration.

µSysCom

3SWT

Main Characteristics

IEC-61850 certified, so reliability is assured in the most stringent environments.

Extended operating temperature range, from -40º to +85ºC, no moving parts.

Modular Gigabit Ethernet ports

Possibility of redundant power supply

Power over Ethernet enabler

Configuration through local or remote console, through it's integrated web server, or via SNMP

Advanced security features implemented

High speed implementation of RSTP function, according to IEE802.1D standard, for fast recovery in link failures

Description

uSysCom 3SWT managed switch family is intended to be installed in IEC-61850 electrical substation networks, so, availability, efficiency and robustness are granted.
They not only fulfill the stringent levels in temperature range and electromagnetic immunity defined in the 61850-3, but also the advanced functional requirements defined for operation with other IEC-61850 devices.

Main features

uSysCom switches give the user all the required functions for an easy configuration of a reliable network within an electrical substation.

IEC61850 certified:
IEC61850-3 hardware environmental requirements.
IEC61850 functional requirements.

Modularity in number and type of ports
Different combinations in number and type of copper, multimode fiber and singlemode fiber in 10/100 Mbps and 1000 Mbps ports.

DHCP Relay and Option 82

Redundancy in power supply
Possibility to increase the switch availability by having a second power source in case the first one fails.

Power over Ethernet enabler
uSysCom switches can directly power up any PoE enabled device following the 802.3af standard. This way an IP phone or a wireless access point, can be powered with the same cable that is used for data transmission.

Failure contact alarm
Hardware contact that is activated when a link problem occurs.

Logs and alarms
3SWT creates logs where statistics about link status alarms are stored with the accurate timestamp, so all events can be traced.

Advanced security features
3SWT has advanced security features implemented to avoid unauthorized access to the system. It has different user levels with different passwords, the possibility to work with different VLANs, following the 802.1Q standard, port security based on MAC addresses, possibility to disable unused ports, authentication protocols ...

High Speed implementation of RSTP and MSTP
In high availability networks it is important to have a fast path recovery when any failure occurs. 3SWT not only follows the STP and RSTP protocols, but also exceeds the usual recovery time of these protocols due to its high speed implementation of RSTP, which grants fault recovery times lower than 4 ms. per link, always fulfilling the RST protocol.

SNMP management
Easy integration of monitoring tools and alarms notifications in an SNMP based central management system, such as HP Openview.

NTP client
3SWT internal clock can be synchronized from a network SNTP/NTP server, so all time stamped events can be referenced from a reliable time reference.

Port bandwidth limiting
3SWT allows the limitation on bandwidth accepted for unicast, broadcast, multicast, or all type of traffic per port. This way resources for non critical services can be limited.

Broadcast Storm Control and IGMP snooping
Limiting broadcast traffic grants that no malfunctioning device saturates the network with undesired and uncontrolled broadcast traffic.

Port mirroring
User can configure one port to replicate traffic flows of different ports, so the system administrator can monitor the incoming, outgoing, or all kind of traffic that is going through the ports under study.

Statistics
User can access the traffic statistics per port live.

Quality of service
User can define different priorities for different ports, so critical traffic is dealt with first.

uSysCom switches fulfill all the required functions to set up a RELIABLE network within an electrical substation following the IEC-61850 standard.

Human Machine Interface

uSysCom switches have a set of LED's in the front panel. They provide relevant information about the switch and about each port:

ON: Indicates that the 3SWT power is on.
PoE: Lights up when PoE power supply is connected.
SRV: Lights up when there is activity through the serial port.

For each port, the following LEDs are available:

PoE On: Only for ports including PoE. Lights up when a PoE device is connected to that port.
Duplex/Col: Blinks when collisions occur and it informs if the port is Half or Full Duplex
Speed/Link/Act: Indicates different link speeds depending on the LED colour. When it blinks, it informs that there is activiy through that port.

Switch configuration

uSysCom 3SWT switches family can be configured using the following procedures:

- Web Interface
- CLI (Command line interface)
  - Local serial console
  - Telnet
- SNMP

Web Interface Configuration

uSysCom 3SWT switches integrate a configuration web server. These web pages are very user friendly and fast to load, allowing access to all the configuration parameters either locally or remotely.

Command Line Interface Configuration

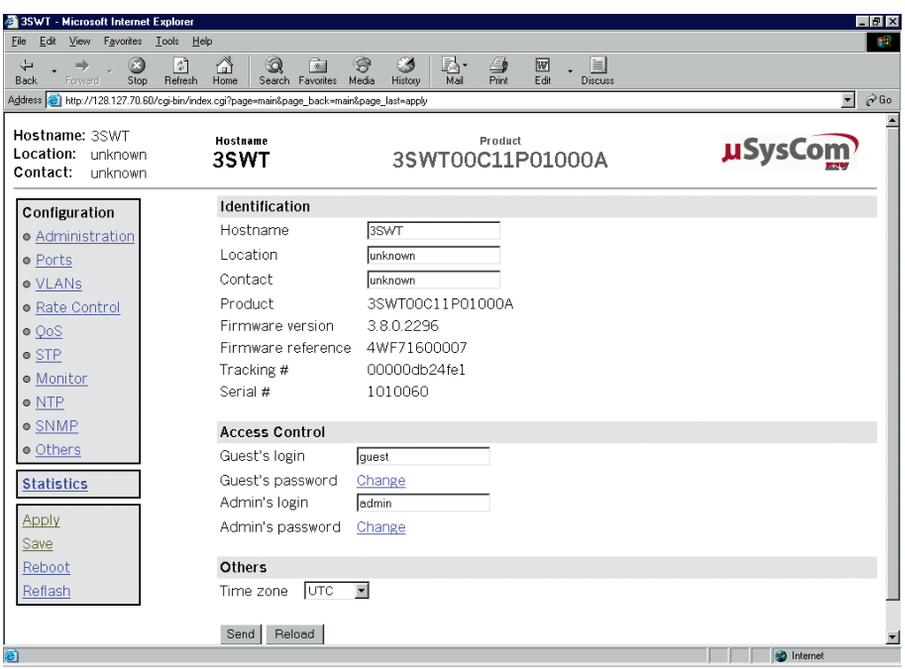
Accessible locally by connecting to the serial console port, or remotely connecting to the switch via telnet:

- Different user profiles available, with different permissions.
- Three command types available:
  - Configuration. set, get, add, remove, cd, restore, download
  - Control. reboot, save, apply, reload, quit, exit
  - Diagnostics. stats, ping, route, traceroute
- Configuration based on a directory tree that contains all the configuration parameters of the switch.

It is also possible to configure the 3SWT by downloading a configuration file from the CLI.

SNMP Configuration

uSysCom 3SWT switches can be easily integrated in a central management tool based in SNMP, such as HP-Openview. There is no need to load or configure specific patches in the central tool, since all the MIBs required to control uSysCom switches are standard MIBs. uSysCom provides technical information to add the 3SWT switches to an SNMP based management tool.



User friendly functions for 3SWT switch configuration and management.

Reliable Ethernet communications within electrical substations

uSysCom switches permit the required reliability for a substation automation system to be based on an Ethernet network, as defined in the IEC-61850 standard.

Application fields

Reliable architecture

Network topologies within the electrical substation may vary depending on the number of services, number of substation cabinets, and number of different networks the electrical company would like to define.

3SWT switches have the right double port configuration to set up any of the topologies a network architect could imagine. The typical architectures within substations are stars, double stars, rings, double rings, and concatenated rings.

Grouping services

It is convenient for electrical companies to have the different services within the substation separated and not accessible one from the other.

In order to achieve this separation of traffic, different VLANs per service can be used. This way, different company departments will have access to their VLANs, and hence, only to the devices and equipment, under their own responsibility.

Critical Services

The services running in an electrical substation may be different in importance. It is not the same to have IP telephony as it is to send orders to open a breaker.

Using the quality of service feature for the different services allows electrical companies network architects to identify the critical services within the substation, warranting that all that traffic is treated with the adequate priority.

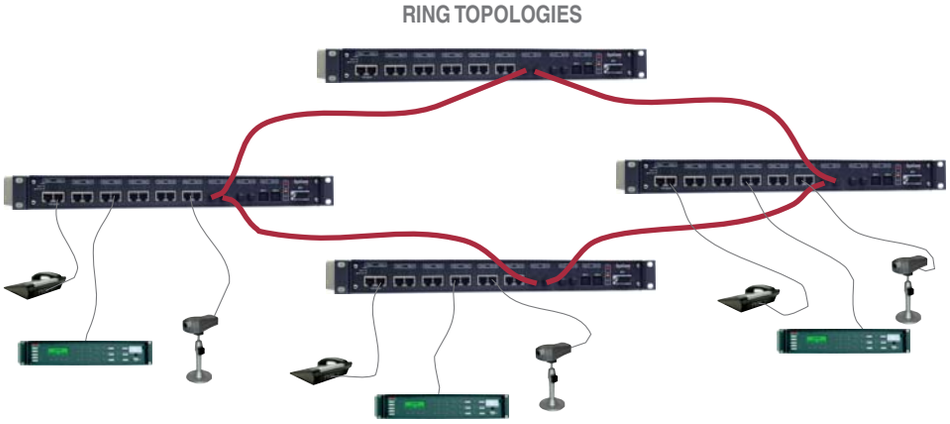
GOOSE management.

Above all the critical traffic in an IEC-61850 substation, you have the GOOSEs traffic, which can be tripping orders from protection relays.

3SWT is designed to treat that special traffic as its highest priority, so, even when the network is congested, a GOOSE will reach its destination in less than the time defined (4-10 ms depending on the performance class) in the IEC-61850 standard.

STAR TOPOLOGIES

RING TOPOLOGIES



Different services at the substations are separated into various VLANs with different priority, depending on the service requirement

Standards and Type Tests

FUNCTIONAL

CONFORMS to **EN 61850-10** functional tests for "*Operation and VLAN Integrity*", "*Quality of Service and Priority*" (**IEE802.1Q**) and "*Operation in Ring Fault Recovery*" according to the Rapid Spanning Tree (**IEE802.1D-2004**).

ENVIRONMENTAL

CONFORMS to**IEC 61850-3 Par. 5** (EN 60870-2-2 (1996)) for "*Cold test"* for 16 hours at -40ºC *(***EN60068-2-1, part 2***), "Dry heat test"* for 16 hours at +85ºC *(***EN60068-2-2, part 2***) and "Damp heat steady state in operating mode"* for 96 hours at +45ºC, 98% relative humidity *(***EN60068-2-78, part 2***)* and "*Change of temperature for transport mode"* for 5 cycles of -40ºC to +30ºC, 98% humidity, 3 hours per step *(***EN60068-2-14, part 2***).*

MECHANICAL

CONFORMS to **IEC 61850-3 Par. 5** (EN 60870-2-2 Table 3 Class Cm) for "*Sinusoidal vibration"* with 2-500 Hz, up to 2g *(***EN60068-2-6, part 2***), "Shocks"* with 30g for 11 msec, 6 pulses per axis *(***EN60068-2-27, part 2***) and "Free fall"* with 2 falls on concrete floor from a distance of 25 cm. *(***EN60068-2-32, part 2***).*

EMC

CONFORMS to **IEC 61850-3** (2002) in the following EMC related paragraphs:

5.7.1.1 Induced disturbances. CONFORMS to **IEC 61000-4-6** (1996): "*Conducted disturbances induced by radiofrequency fields immunity test*" with levels of 10 Vrms (class 3), in the range of frequencies from 0.15 to 80 MHz (**class 3**).

5.7.1.2 Surges. CONFORMS to **IEC 61000-4-5** (1995) with levels of ±4 kV common mode applications and ±2 kV differential mode applications (**class 4**).

5.7.1.3 Oscillatory waves. CONFORMS to **IEC 61000-4-12** (1995): "*Oscillatory waves immunity"* testing the paragraph relating to damped oscillatory waves of 100 kHz and 1 MHz for levels of 2.5 kV in common mode and 1 kV in differential mode (**class 3**).

5.7.1.4 Fast transients. CONFORMS to **IEC 61000-4-4** (1995): "*Electrical fast transient/burst immunity test*" with levels of ±4 kV (power supply and earth terminals and ±2 kV (ethernet communication terminals) (**class 4**).

5.7.2 Radiated electromagnetic disturbances. CONFORMS to **IEC 61000-4-3** (1995): "*Radiated, radio-frequency, electromagnetic field immunity test*" with levels of 10 V/m in the range of frequencies from 80 to 1000 MHz (**class 3**).

5.7.3 Power frequency disturbances. CONFORMS to **IEC 61000-4-8** (1993): *"Power frequency magnetic field immunity test"* for continuous applications of 100 A/m, 50 Hz and 2 s applications of 1000 A/m, 50 Hz (**class 5**). CONFORMS to **IEC 61000-4-10** (1993): *" Damped oscillatory magnetic field immunity test"* for applications of 100 A/m at the frequencies of 100 kHz and 1 MHz (**class 5**). CONFORMS to **IEC 61000-4-16**: *"Power Supply frquency"* for 30V in continuous mode, and 300V for 1 sec.

5.8.EMI radiation. CONFORMS to **EN 55022** (1998): *"Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement"* for **class A** limits.

POWER SUPPLY

CONFORMS to **IEC 61850-3** (2002) in the following Power Supply related paragraphs (IEC 60870-2-1):

6.2 Power Supply Voltage Range. CONFORMS to **IEC 60870-2-1 Tables 1 and 5**.

6.3 AC and DC Power Supply Voltage Tolerance. CONFORMS to **IEC 60870-2-1 Tables 2 and 6.**

6.4 Voltage interruptions (10 ms interruptions)**.**

6.5 Power Supply Quality. CONFORMS to **IEC 60870-2-1 Tables 3, 4, 7 and 8.**

3SWT is IEC-61850 certified, and interoperates with any manufacturer IED that complies with the IEC-61850 requirements.

All the models satisfy the 89/336/CEE electromagnetic compatibility European directive.

CE

Warranty

All products and services sold by uSysCom are warranted against any defect in design, materials and workmanship for a period of five years after delivery.

Quality

uSysCom is an ISO 9001-2000 certified company

uSysCom is highly commited to their customers, with a Continuous Improvement Plan, within the framework of Total Quality Policies.

Assistance

uSysCom technical service is available locally to customers world-wide, either from our own personnel (in Spain, Brazil and North America)or from our extensive network of local collaborators in other countries.

Additionally, there are different permanent assistance services (24 hours /day, 365 days/year) for inmediate support

24 h. Service for Spain and Europe

24 h. Service for Brazil and South America

24 h. Service for U.S.A. and Canada

Technical data

HARDWARE

Physical dimensions

Dimensions mm. (H x W x D): 38 x 432 x 246
19" Rack mount: 38 x 432 x 246
DIN Rail: 166,5 x 65 x 115
Weight: 4,5 Kg
Enclosure material: Stainless steel

Operating ranges

Operating temperature: - 40ºC to +85ºC
Operating **humidity**: 99% non condensing
Operating **altitude**: 10.000 m.
Storage Temperature: - 40ºC to +85ºC

Isolation

Between **contacts and enclosure**: 2500 Vrms
Between **power contact and others**: 2500 Vrms
Between **RJ45 ports and enclosure**: 1500 Vrms
Between **Digital I/O and enclosure**: 2500 Vrms
Between **serial port and enclosure**: 1000 Vrms

RJ45 characteristics (IEC61850-3 without affecting communication)

Surges of ± 4KV in common mode /waveform 10/200us)
Fast transients: ± 2KV
Oscillatory waves: ± 2.5 KV common mode, ± 1KV differential mode

Power Supply

Power consumption: Typical <18 Watts
Power Supply ranges:
20-75VDC
60-260VAC / 60 – 360VDC (multirange)
Isolated 6-36VDC
Optionally, two power supplies can be mounted, with charge balance, for **redundancy** purposes.
Optionally, it can include an internal **PoE** (IEEE 802.3af) supply, which can power directly up to 4 IP phones.
PoE Power Supply option: Max.PoE power: 12W
The status of each power supply can be monitored.

Ports

Up to 40 Fast Ethernet ports, 10/100BaseT or 100BaseFx (factory option)
Up to 4 **Gigabit Ethernet SFP slots** are available, which can be converted to a variety of port types depending on the accessories selected.
Auto MDI-X crossover, detecting a crossed or flat cable connection

Accessories

The four Gigabit Ethernet expansion slots can provide the following kinds of ports:
Copper (RJ45)
1000BaseSX: 850nm multimode LC connector (up to 500 m)
1000BaseLX: 1310 nm singlemode LC connector (up to 10 km)
1000BaseZX: 1550 nm LC connector (up to70 km)
100BaseFX: 1310 nm singlemode LC connector (up to 10 km)
100BaseFX: 1310 nm multimode LC connector (up to 2 km)

SOFTWARE

VLANs

3SWT supports **250 simultaneous VLANs**
VLAN id's 1 to 4094
Q-in-Q support

Quality of Service (QoS)

Diffserv architecture: (PHB)Per-Hop Behavior
Within a QoS domain – IEEE 802.1p / CoS IP fields
Outside a QoS domain: Priority assigned by 3SWT depends on the origin MAC, destination MAC, port or VLAN

Performance

Full "wire-speed" switching
Port speed automatic detection
Per-port storm control

Redundancy

IEEE 802.1D-2004 – Rapid Spanning Tree Protocol
MSTP
Redundant power supply and extra PoE power supply (optional)

Management interfaces

cli: serial console or telnet
snmp
web

NTP client embedded

Firmware upgrade

Just by downloading a file image (https)

Tools for ports configuration

Port mirroring

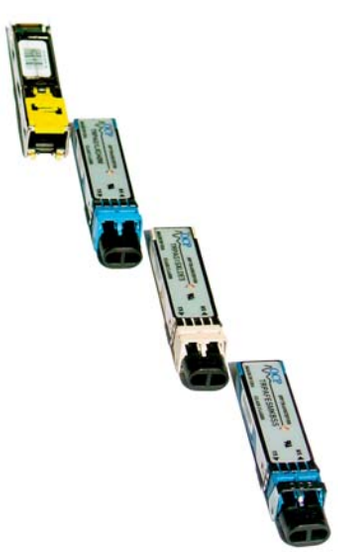
IGMP Snooping

DHCP Relay (+ Opt.82)

Advanced Authentication Protocols supported (TACACS, RADIUS...)

Switch status monitoring

Light indications in the front cover
Detailed information about every single port in the switch



Model selection

Specific model, depending on the required characteristics, can be selected using the following chart:

3 S W T -

Number of Ports	Cod.
16 standard ports	0
8 standard ports	A
6 standard ports	M
24 standard ports	N
32 standard ports	S
40 standard ports	P

Type os Main Ports	Cod.
RJ45 Copper cable	0
Multimode Fiber Optics: MTRJ	1
Singlemode Fiber Optics: MTRJ	2

Number of Secondary Ports	Cod.
No secondary ports	0
Last 2 ports	D
Last 4 ports	C
Last 8 ports	M
Last 16 ports	T

Type of Secondary Ports	Cod.
RJ45 Copper cable	0
Multimode Fiber Optics: MTRJ	1
Singlemode Fiber Optics: MTRJ	2
None	N

Power Supply	Cod.
Isolated 20-75 VDC terminal block	0
60-260VAC@47-63Hz /60-360VDC) terminal block	1
Isolated 8-36 VDC	2
Non Isolated DC (6-36 VDC)	6

Redundant Power Supply	Cod.
Not present	N
Isolated 20-75 VDC	0
60-260VAC@47-63Hz /60-360VDC) terminal block	1
Power over Ethernet enabler 20-75 VDC	P
Power over Ethernet enabler 60-260VAC60-360VDC	E

Gigabit Ethernet port	Cod.
Not Ready	0
2SFP slots available	M
4SFP slots available	F

Enclosure	Cod.
Rack mount (front ports)	2
Rack mount (rear ports)	E
DIN Rail mount	W

Extra PoE power supply	Cod.
None	0
PoE enabler 20-75VDC	P
PoE enabler multirange	E

Factory defined	Cod.
Default	0

Factory defined	Cod.
Default	0
DIN41 612 Female - 1 Fast Ethernet Port	1
DIN41 612 Female - 4 Fast Ethernet Port	4

Factory defined (REV)	Cod.
Default	A

Accessories

SFP Modules for expansion slots

Gigabit Ethernet SFP modules

4CZ07980001	SFP 1000BaseT.
4CZ07980002	SFP 1000BaseSx, 850nm, multimode, distance 550m.
4CZ07980004	SFP 1000BaseZx, 1550nm, singlemode, distance 80Km
4CZ07980005	SFP 1000BaseLx, 1310nm, singlemode, distance 10Km.
4CZ07980008	SFP 1000BaseLx, 1310nm, singlemode, distance 40Km.

100Mbps Ethernet SFP modules

4CZ07980006	SFP 100BaseFx, 1310nm, , singlemode, distance 10Km.
4CZ07980007	SFP 100BaseFx, 1310nm, , multimode, distance 2Km.

Pigtail Cables and Fibers

4GL03000141	Flat RJ45 STP CAT6 cable 3m. long.
4CZ05000010	Multimode Fiber MTRJ-MTRJ 2m. long
4CZ05000011	Multimode Fiber MTRJ-SC 2m. long
4CZ05000012	Multimode Fiber MTRJ-ST 2m. long
4CZ05000013	Multimode Fiber MTRJ-LC, 2m. long
4CZ05000014	Multimode Fiber LC-LC, 2m. long
4CZ05000015	Singlemode Fiber LC-LC, 2m. long

The selection of an accurate switch for every topology is facilitated with its versatile number of options and type of ports, together with the different accessories.

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