

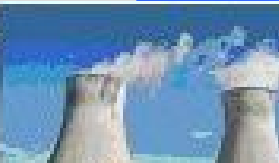
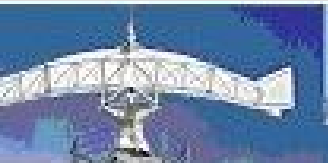
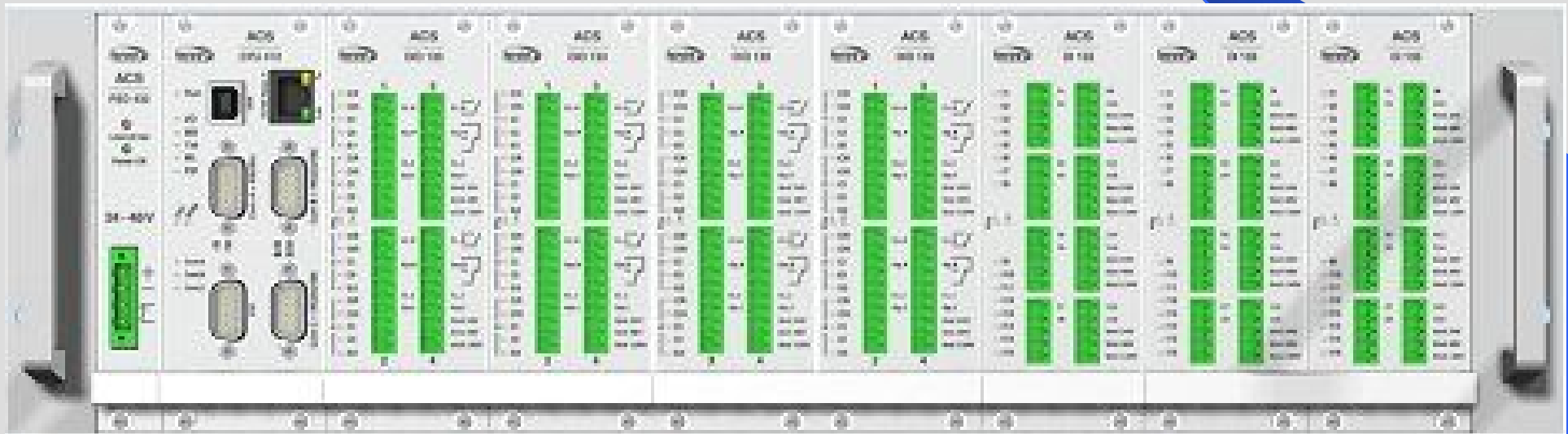


Manufacturer of automation products for harsh environments



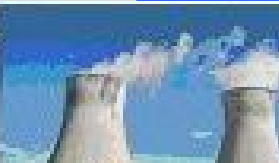
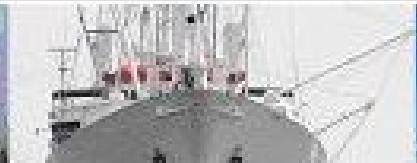
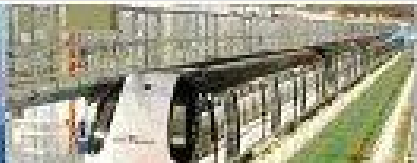
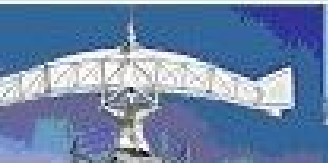
# ACS

## *Suitable PLC for energy management*



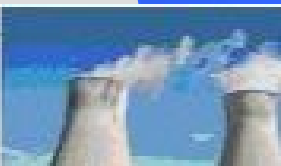
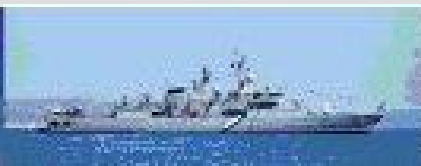
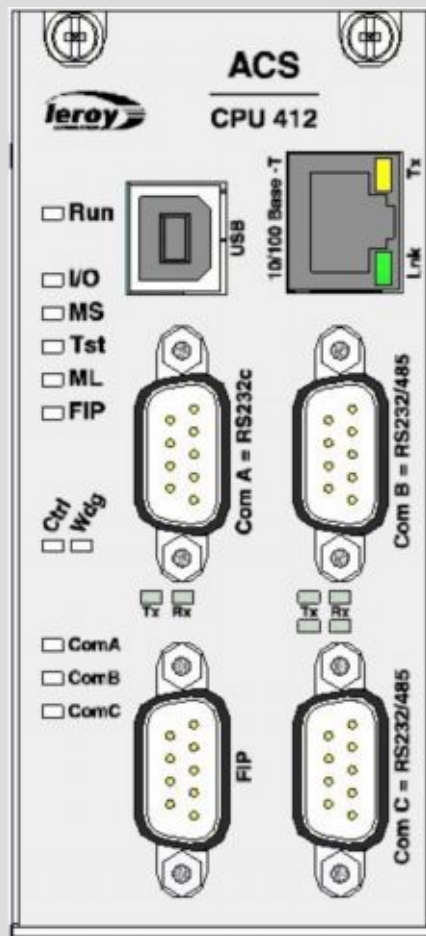
# *ACS : rack configuration*

- *6 standard 19 inches racks max*
- *8 I/O blocks by rack*
- *= 1 UC + 47 I/O blocks max*
- *Power supply block on each rack*



# ACS CPU

## Performance, Safety, Communication



# *ACS CPU Features*

Processor	PXA255/PXA270 Marvel (ARM technology)
Rate	300 MHz
RAM	32 Mo
Flash ROM	16 Mo
Programming channels	USB or Ethernet



# ACS Safety

- *The CPU card includes a microprocessor watchdog.*
  - ✓ *The processor activates regularly the monitor; if not, it initializes again the processor .*
  - ✓ *More than 3 ms of a central processor inactivity, lead to a fallback of the outputs.*
- *The CPU program can detect the absence or inadequacy of a module regarding the declared configuration.*



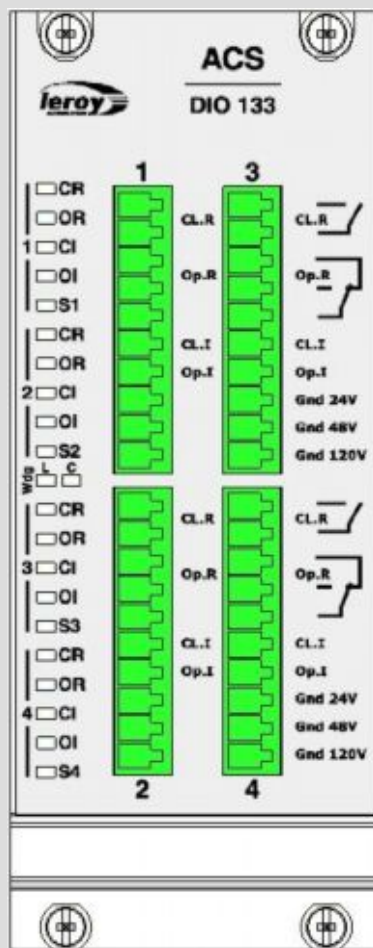
# ACS Communications features

- **1 Ethernet port 100Mb IEEE 802.3**
  - **DNP3.0 Outstation (slave) over Ethernet :**  
*embedded library from Triangle MicroWorks , Inc*
  - **Modbus/TCP slave and master**
  - **real time exchange of variables between all ACS**  
*(event based communication binding)*
  - **HTML dynamic process pages (ActiveX technology)**
  - **Workbench console link**
- **2 serial links RS232/RS485 to protection relays :**  
*modbus/RTU master protocol*
- **1 serial link RS232c to modem**
- **USB : local workbench console link**

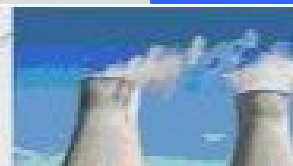
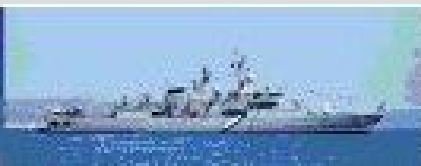
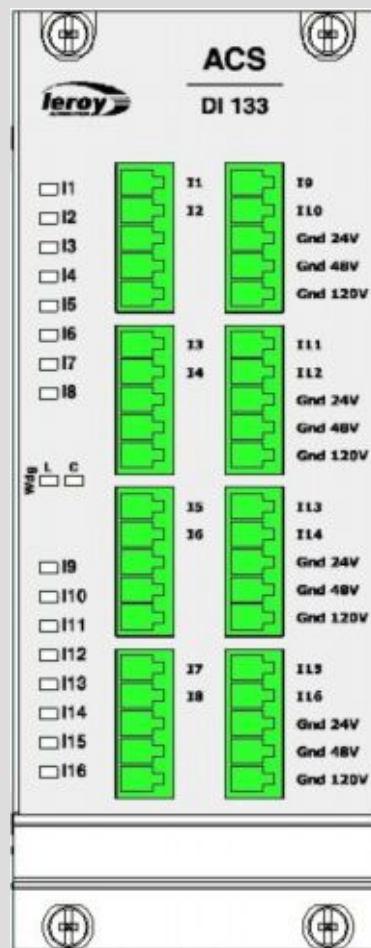


# ACS : inputs/outputs blocks

DIO133



DI133



# ACS

## *Secured Inputs/Outputs Blocks*

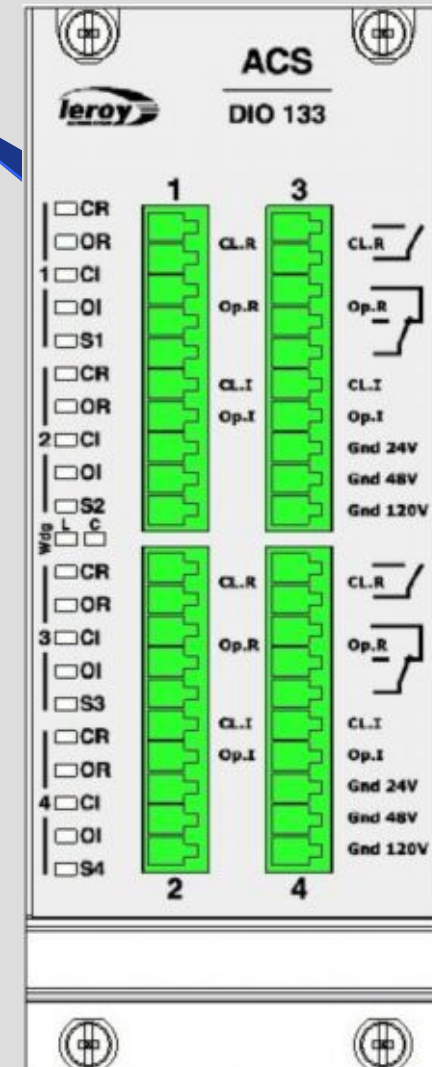
- *Each block is self monitored.*
  - ✓ *Monitoring of the refresh time of the CPU block .*
  - ✓ *Monitoring of the refresh time of each input/output block.*
  - ✓ *Monitoring of internal power supply voltage .*
  - ✓ *Monitoring of the data coherence and address bus.*
  - ✓ *On problem detection, the block is fallback.*



# ACS

## DIO133 configuration block

- 1 block = 4 control systems
- 1 Control system =
  - 1 Switch on output relay
  - 1 Switch off output relay
  - 1 « system opened » input
  - 1 « system closed » input
- Choice of power supply : 24, 48 or 120Vdc



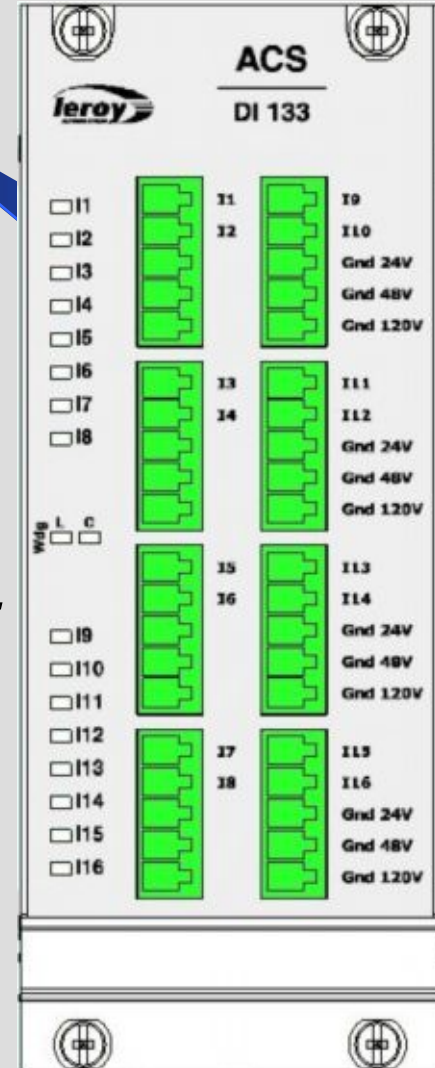
# ACS : DIO133 Control securing

- *Monitoring of each outputs relay :*
  - ✓ *Monitoring of the current before and after the coil relay.*
- *Management of each relay by four serial controls :*
  - ✓ *The first command of the relay*
  - ✓ *The redundant command of the relay*
  - ✓ *Permission by the Local Watchdog on board*
  - ✓ *Permission by the General Watchdog of the PLC*



# ACS : DI133 configuration

- 16 Redundant inputs
  - ✓ Two logical circuits by input.
  - ✓ Two information bits for each input : an input state bit and a fault bit.
  - ✓ Checking and transmitting to the CPU : 1 state bit and 1 fault bit
- Choice of power supply : 24, 48, 120V DC



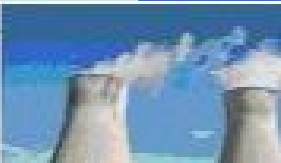
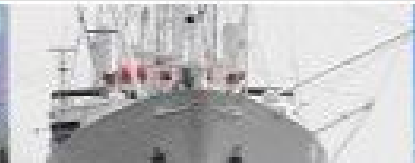
# *ACS : A safe internal bus*

- ⊕ *Redundancy of the power supplies  
12V and 5 V on the rack.*
- ⊕ *The pins addresses of rack and block  
signals are redunded.*
- ⊕ *Redundancy of the WDG signal with its  
complemented value.*
- ⊕ *Internal USB protocol secures the data exchanges.*

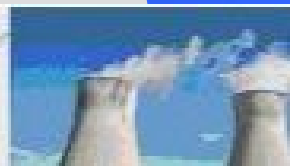
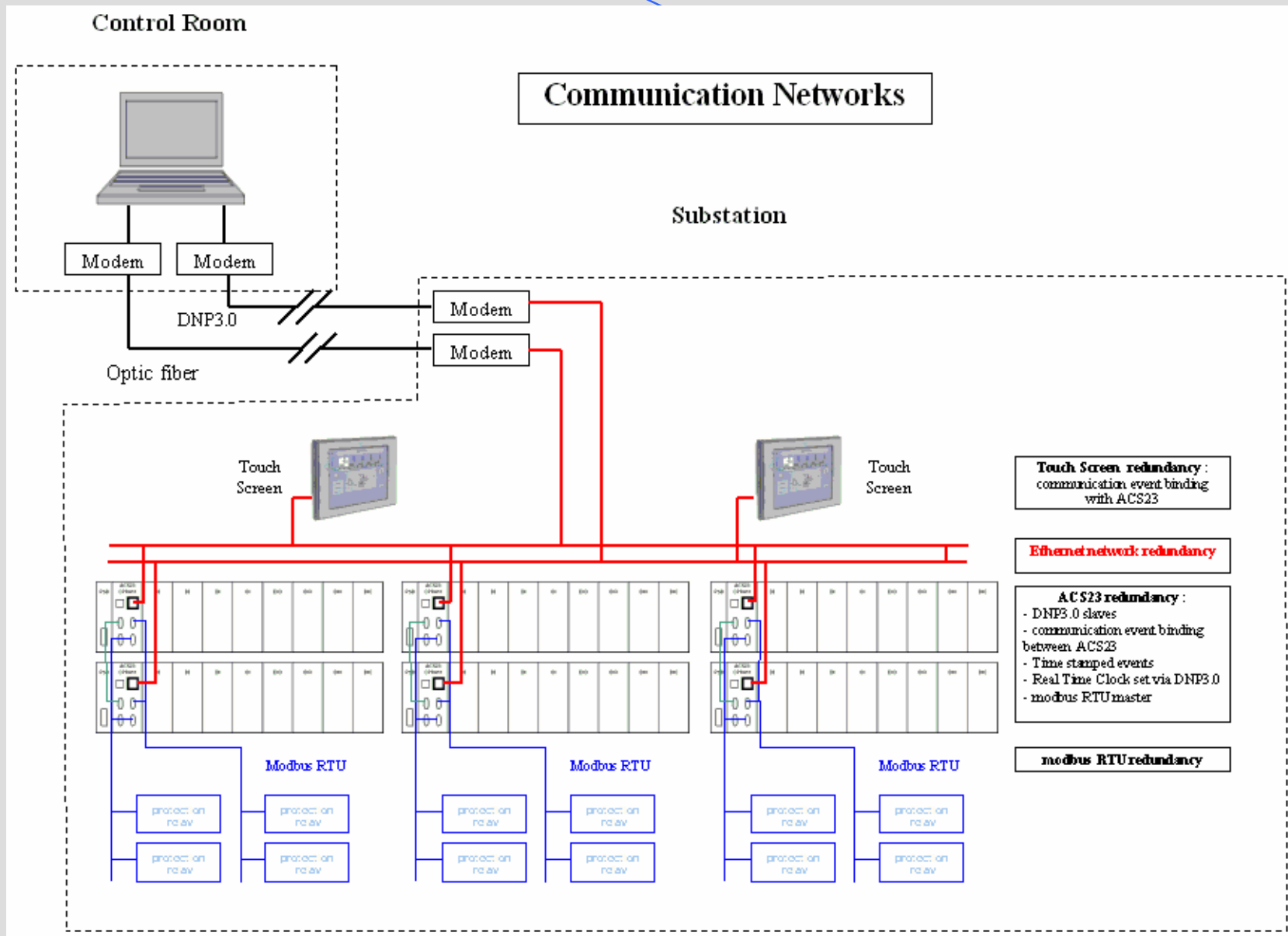


# *ACS programming*

- ✦ *Embedded Operating System :*
  - Linux 2.6.12*
- ✦ *IEC61131-3 Workbench*
  - ✦ *Korean language*
  - ✦ *Programming languages : Ladder, Sequential Function Blocks, Sequential Function Blocks, Structured text*
  - ✦ *fieldbus configuration tool : just-in-time variable declaration*



# Substation automation diagram



# *Substation automation : particular ACS functions*

- *Substation process management*
- *DNP3.0 Outstation (slave) Level 2*
  - ✓ *Communication with Main SCADA :  
time-stamped events, orders from Scada*
  - ✓ *Time synchronization with Main Scada clock*
- *Sequence Of Events (SOE)*
  - ✓ *Events timestamping with millisecond resolution*
  - ✓ *32768 maximum events : FIFO management*
  - ✓ *file of events available via FTP protocol*
- *Real time exchanges between all ACS (binding)*
- *Modbus/TCP communication with touch screens*
- *Modbus RTU communication with protection relays*



## *Substation automation : ACS redundancy*

- *Activity management between both main and redundant ACS*
  - ✓ *Safety : two communication links : serial and Ethernet*
  - ✓ *Automatic change of activity, depending on : input/output blocks states, Ethernet state and modbus RTU communication with protection relays state.*
- *Each ACS Ethernet link on two Ethernet switches*
- *Digital Input wiring : parallel wiring on both ACS (internal diodes on input boards)*
- *Digital Relay Output wiring : both ACS are wired on the same load*



## *Substation automation : Ethernet redundancy*

- *Two Ethernet networks managed with two Ethernet Switches*
- *A specific link between both Ethernet Switches allows the communication between both networks*
- *Safety : if one of both switch fails, the other will continue to allow the management of the substation*
  - ✓ *The first switch for all main ACS's*
  - ✓ *The second switch for the redundant ACS's*

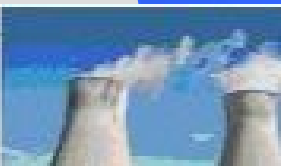
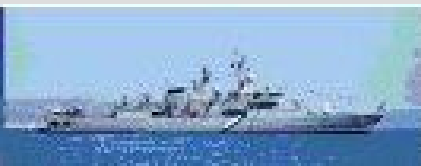
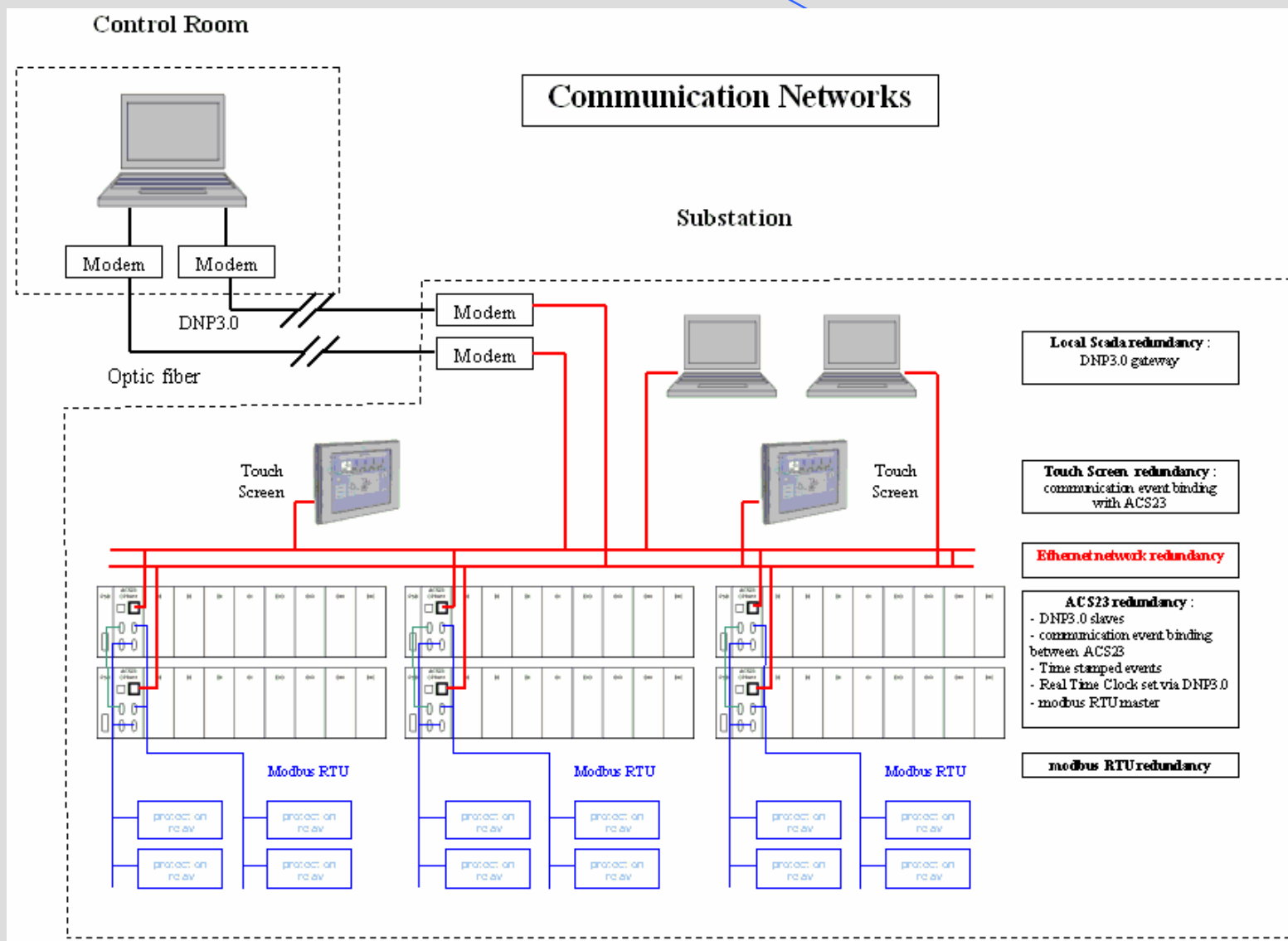


## *Substation automation : Touch screen redundancy*

- *Two Touch Screens plugged on each Ethernet networks (main and redundant)*
- *Touch Screens programs : the same program will be in both Touch Screens*
- *Each Touch Screen will be able to monitor the whole substation.*
- *Safety : if one of both Touch Screen fails, the other will continue to allow the local management of the substation*



# Substation automation : with Local Scada



## *Substation automation with Local Scada*

- *Local Scada features (from Triangle MicroWorks):*
  - ✓ *gateway : DNP3.0 slave with Main SCADA, DNP3.0 master with ACS*
  - ✓ *internal tags created and mapped*
  - ✓ *equation editor for new data*
  - ✓ *display : channels, mapping, diagnosis, current values and quality status, protocol analyzer*
  - ✓ *possibility of redundancy function*
- *Each local Scada is plugged on one different Ethernet Switch*



# ACS : Improvements regarding the LT160

- Capacity : ACS: up to 47 blocks .versus. LT160 : 15 blocks
- Switching power of output relays : ACS : 800mA / 120VDC .versus. LT160 : 500mA / 120VDC
- Internal bus : more reliable (USB protocol and redundancy)
- Ergonomics : easier diagnosis of the product
  - The diagnosis is progressive from the relay level > control system > block > PLC
- Better thermic dissipation : Deeper board size, Spaced boards
- OS : ACS : Open Linux 2.6.12 versus LT160 private OS
- Cycle time : ACS = LT160 / 20

