

ELECTRIC TRACTION CONTROL SYSTEM

.....when the collaboration is faster than the bureaucracy

TECNAU Transport Division s.r.l

Since 14th December 2002, a new remote control system for electric traction (SCTE) has been in use in the Firenze - Campo di Marte control station. Thanks to close collaboration between RFI personnel and TECNAU technicians, it took only one year to set up the system (actual time from specifications to activation). Below we describe the scenario in which the new ET remote control station has been developed, together with its technical characteristics.

Current situation with regard to IEMS systems.

As already described in the article by Alvaro Fumi published in the magazine "La Tecnica Professionale" in June 2002, the ET remote control stations currently operating on

the FS network fall into two groups: *Traditional* (13) and *Computer-operated* (15). We need not describe systems of the traditional type here, but we wish to specify that almost all the computer-operated systems currently in use are the outcome of the earliest experiments in the field of information

technology, which reached their height with the activation of the Bolzano IEMS (1989). These systems employ a HW and SW structure that is to a large extent proprietary (100% in some cases), which makes it difficult for them to be extended, maintained or integrated (obsolete HW not available on the market).

The method of operation, by means of a special keyboard, was revolutionary in the '80s but is too laborious nowadays; simple activities, such as masking an alarm,

sometimes become demanding operations that can be carried out only from maintenance position. In view of this, a couple of years ago the FS embarked on a policy of replacing the systems, with the ultimate aim of having only one ET remote control

system, using cutting-edge technology, for each division.

Introduction to the SCTE system.

The SCTE system was developed in order to allow peripheral locations on the Chiusi(e) – Attigliano(e) section of the Florence-Rome



Fig. 1 – Control position of the SCTE system at RFI Firenze Campo di Marte

line LL(normal speed) and the Montallese(e) – Bassano(e) section of the Florence-Rome line DD (high speed) to be included in the remote control system, under the jurisdiction of the Compartimento di Firenze. The SCTE system is a personalized version of the basic SCADA product developed by TECNAU s.r.l. In the case of the RFI Compartimento di Firenze, the version supplied was the “*SCTE Stand-alone*”, which has no redundant apparatus except communication links between

Concentrator and Alpha and between Concentrator and peripherals. In designing the SCTE system, the standards recently specified by RFI were taken into account.

HW architecture. The SCTE system consists of a Control Station installed at Campo di Marte, which handles all information to and from the Peripheral Cabins (TIC1000, of the Telettra type) by means of a Concentrator located at Orvieto, in the premises of the SSE

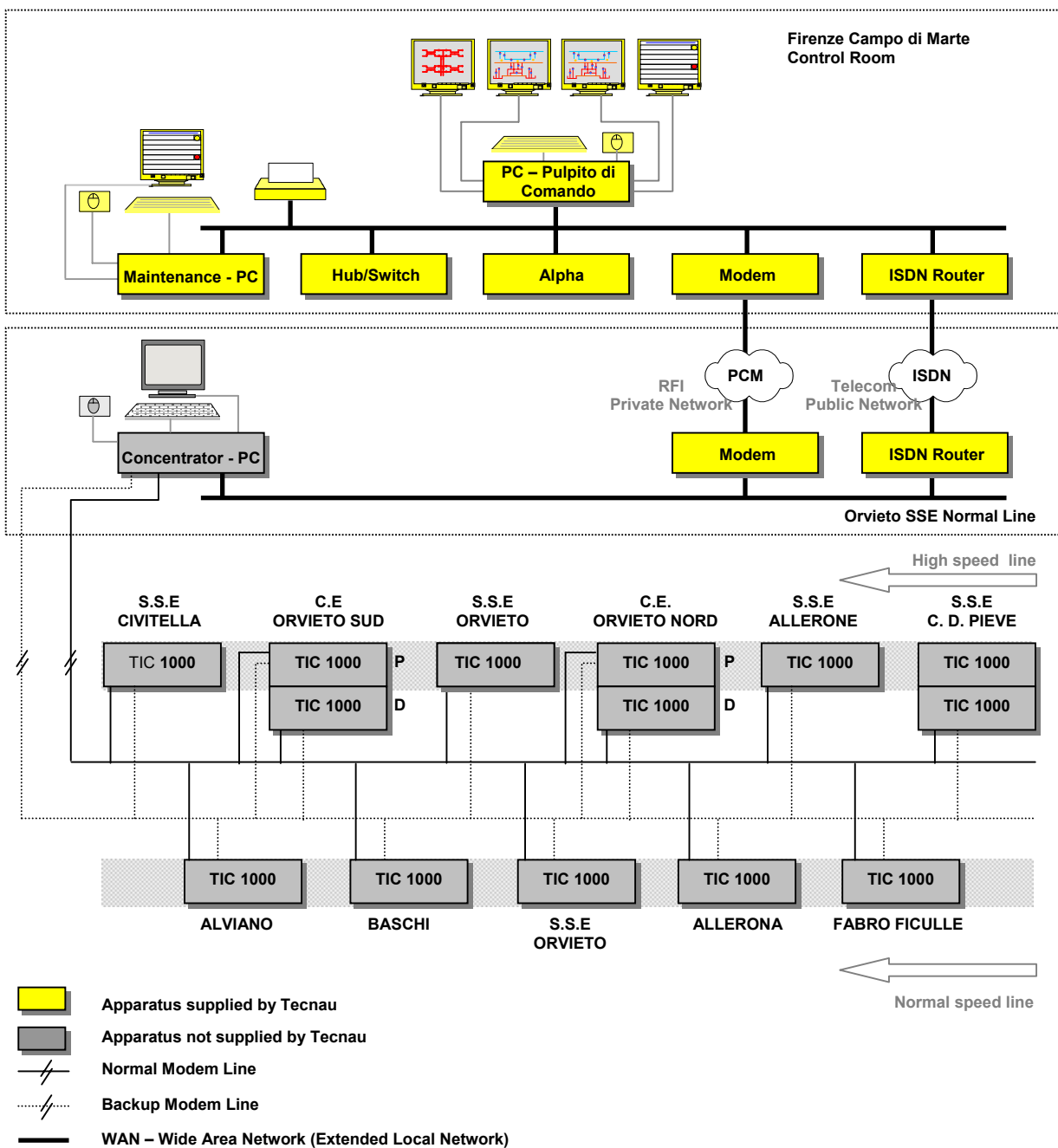


Fig. 2 – HW architecture of the SCTE system, Stand-alone version

of the LL line. The use of TIC1000 cabins must not be considered as a design-driven choice, but rather as a need felt by the customer, who wished to recycle as much functioning material as possible.

Figure 2 shows the HW structure of the SCTE system, Stand-alone version.

In particular, the diagram shows:

- control position consisting of commercial PC, 4 18" LCD monitors, mouse, keyboard.
- Alpha mainframe, distributed by the company HP.
- Maintenance workstation, consisting of commercial PC, monitor, mouse, keyboard.
- Network printer.
- Various network devices, e.g. Hub/Switching device, ISDN router, modem.

In the case of the *extension of the Ethernet network* (manufactured and supplied by TECNAU) from Firenze – Campo di Marte to Orvieto, a PCM channel belonging to RFI has been used as the primary line, while an ISDN channel has been rented from the public operator, Telecom, as a backup line.

SW Architecture. The SW architecture of the SCTE system is based on the Client/Server concept, which allows information to be processed at any node in the network; data can likewise be recorded at any other node. This concept means that all resources, throughout the network, have been rationalized and may be used in a practically unlimited fashion. This design gives the SCTE system a *high degree of flexibility and modularity*, for

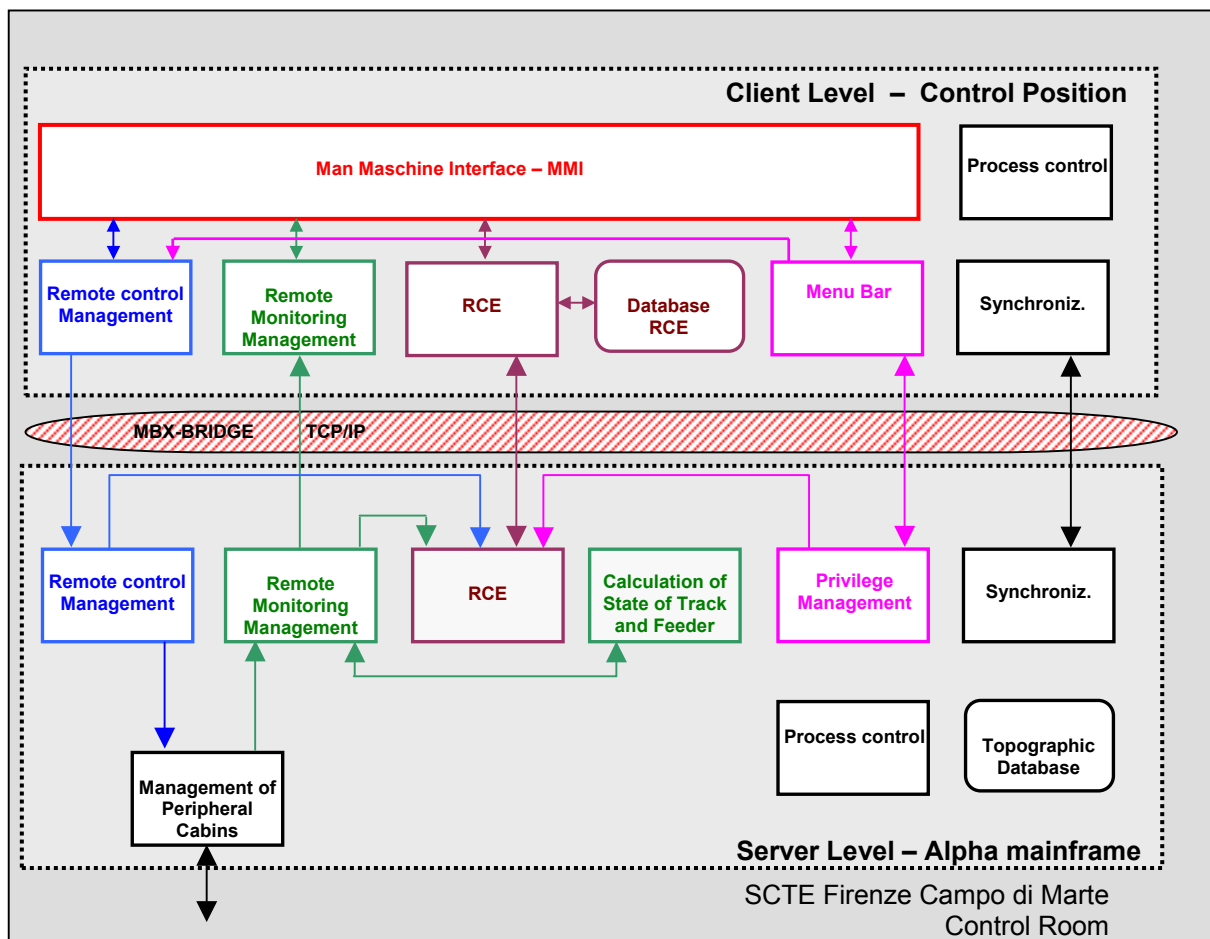


Fig. 3 – SW architecture of the SCTE system, Stand-alone version

example by allocating user processes to computers other than those used for data processing.

In this context, the need to modify components or add new modules represents a problem that can be solved immediately, from the point of view of both Hardware and Software. In the SCTE system, the Server processes are installed on the Alpha mainframe, while Client processes take place on the Personal Computer of the Control Pulpit.

Figure 3 gives a functional diagram showing all the processes that make up the Control Station of the SCTE system.

Figure 3 shows that the Control Station has various SW subsystems; for each subsystem there is a Server block (sometimes consisting of several programs) and a Client block. Arrows indicate how the various subsystems relate to one another. The programming languages used, and indeed the very structure of the programs, allow porting of the entire Server level on state-of-the-art Personal Computers.

Tasks carried out by SCTE. The SCTE system has the following functions:

- **Remote monitoring:** supervision of plant by means of several video terminals providing overall views (Synoptic Panel) and detailed views (Command Pages);
- **Remote control:** possibility of remote control for all devices on the stretch of track controlled;
- **Visualization of State of Feeders:** visualization in real time of the feeders (AT, MT, BT) in relation to the state of the devices; Forcing: possibility of simulating commands;
- **Countermarking:** possibility of countermarking a device (1-5 times) after a module has been released. In this way, the transmission of commands to a countermarked device is prevented.
- **Device Masking:** makes it possible to exclude a device from scansion; this

function is very useful during maintenance operations.

- **Alarm and Signal Masking:** makes it possible to exclude an alarm or signal from scansion.
- **Preventive lock:** the operator is presented with only those commands that are possible at that precise moment.
- **User privilege management:** access to the system is regulated by a procedure for entering User and Password; each operator has his/her own access code (User and Password), unique within the system. A certain profile is attached to each operator. The system can handle 4 different types of profile: *Administrator*, *ET Operator*, *Maintenance Operator*, *Trainee*.
- **Chronological event recording:** all events intercepted by the system are recorded in chronological order in a relational database. The application of suitable filters helps the operator search for historic data.

The functions for managing **SMA** apparatus (*Scambio Moduli Automatico* – Automatic Module Exchange) and **telemetry** have not been installed, because the peripheral cabins (TIC1000) do not support these applications.

Operational aspects. The SCTE system is extremely simple and intuitive to operate. Elements or functions are selected with the mouse; the keyboard is used only for access to the system or to enter optional comments concerning the events recorded. The operator can choose how to allocate the video pages (control pages, synoptic panel, window for handling events) among the 4 monitors. All printouts requested by the operator are sent to the network printer. The system also handles acoustic signals associated with the activation of an alarm or with the spontaneous variation of a device. The phases in the execution of a remote command can be defined as follows:

- **STEP1:** select command page;
- **STEP2:** select device to which a command is to be sent;
- **STEP3:** select command on device;
- **STEP4:** enter (or cancel to interrupt execution of command).

out by the ET operator in the control position) on events incepted by the SCTE system and recorded in the relational database.

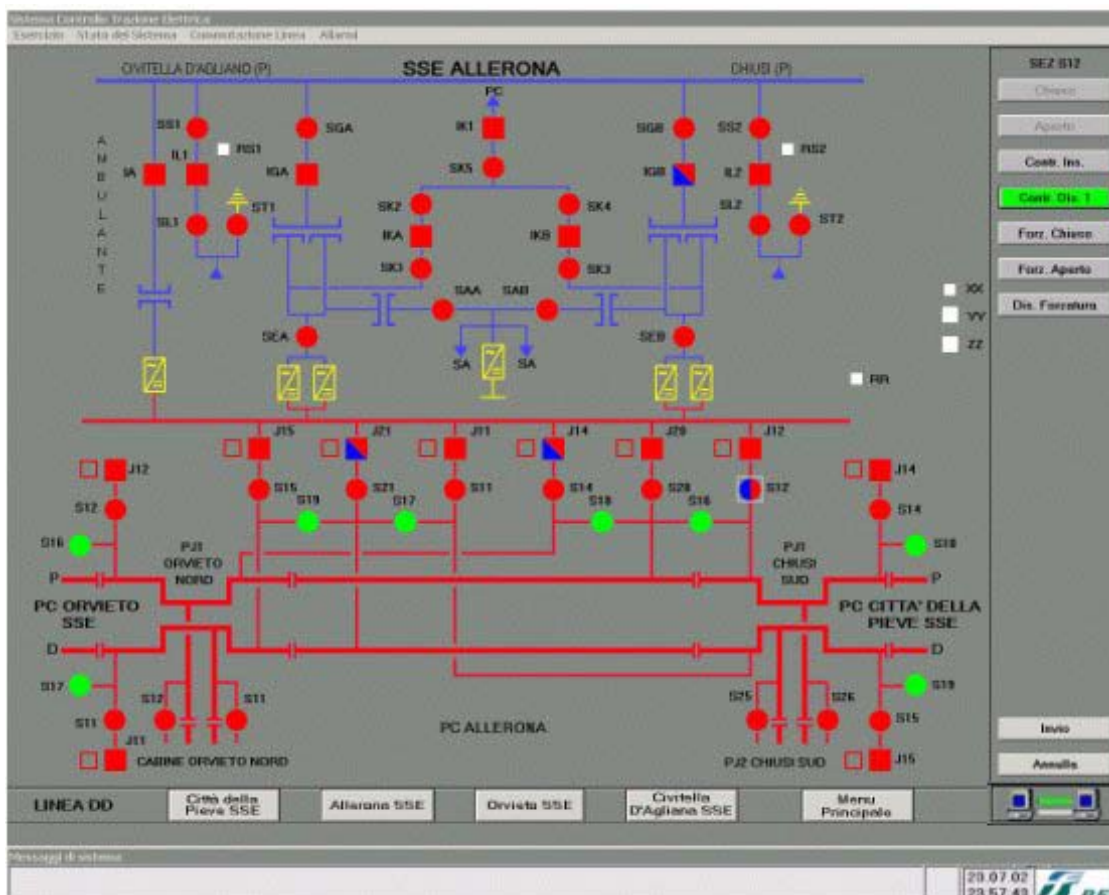


Fig. 4 – Example of procedure to Unblock Countermarking

The command is registered by the program “Chronological Event Recording” and sent to the peripheral. Figure 4 shows an example of the Unblock Countermarking procedure for device S12 at the Allerona Electric Substation cabin.

Configuration of SCTE system.

The program EXCEL is used to compile a number of spreadsheets, which constitute the configuration files for the SCTE system. The configuration files are processed (off line) by special programs, which create the database for the system.

Maintenance Workstation. This consists of an operator workstation for the use of maintenance personnel, installed in the machine room. From this workstation, historical searches may be carried out (in exactly the same way as they can be carried

Reliability. The reliability of the system is ensured by:

- The robust SW of the basic product, SCADA, supplied by TECNAU s.r.l. (The product has been used by FNF Ferrovie Nord Milano in a CTC configuration since 1996 and by FCE Ferrovie Circum Etnea in a CTC configuration since 2001).
- Precision of factory testing.
- Use of top-quality materials.

Remote maintenance. The apparatus constituting the Control Station of the SCTE system does not require ordinary maintenance; everything is entrusted to automatic SW procedures. All extraordinary maintenance activities resulting from unusual situations are described in the maintenance manual. In cases of extreme necessity the SCTE is connected via ISDN with the laboratory of TECNAU s.r.l.

Advantages. The advantages deriving from use of the SCTE system are as follows:

- Rapid installation and activation;
- Easy configuration;
- Robust HW and SW architecture;
- Modular HW and SW architecture, giving the system great flexibility and expandability;
- Possibility of configuring the Server level, i.e. the Alpha mainframe, in Warm-standby mode;
- Possibility of including more than one control position;
- Use of cutting-edge HW that is easily obtainable on the market;
- Possibility of video display on the wall;
- No ordinary maintenance required;
- Easy integration with CTC or SCC systems (SCTE is designed to support the exchange of data with the CTC system supplied by TECNAU s.r.l.);
- High degree of customer satisfaction.

Conclusions. In conclusion, we can say that collaboration between RFI personnel belonging to the Compartimento di Firenze and the technicians of TECNAU s.r.l. has led, in the space of a very short time, to the development of an ET remote control system that is to the client's utmost satisfaction.



Fig. 5 – TecnaU cabinet

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