ERCS
Equipment Remote Control System

EID

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1 PREAMBLE

The performance of modern warships, in terms of communications, is unquestionably of critical importance, since the accomplishment of tactical and operational tasks depends more and more on the efficiency and flexibility of information exchange and gathering.

The increasing complexity of naval communications scenarios requires an efficient management of resources, and also the capability to deal with fast, global and unexpected changes on the whole communications environment. A high degree of automation is thus required, together with the necessity, felt by navies all over the world, of minimising the number of skilled personnel.

Equipment **R**emote **C**ontrol **S**ystem (**ERCS**) was designed and developed specifically to provide an effective equipment remote control management and automation tool, therefore coping with the trends above.

Being more specific, **ERCS** provides the centralised remote control of communications equipment, enabling the effective control and monitoring of its working parameters.

The **ERCS** can be tailored and configured to control of any type of communications equipment.

The system is essentially composed of the following building blocks:

❒ **Remote control front-end units**, providing the necessary remote control interfaces to the communications equipment.

❒ **Management Terminals (MT),** enabling a single operator to take care of the full control and supervision of the system. Through a user-friendly man-machine interface, a comprehensive set of tools is available to the operator, helping him to perform his duties efficiently and with minimum effort. The **Management terminal** is composed of a rugged computer, high-resolution LCD flat-panel colour display, keyboard and track-ball.

The following sections provide a detailed description of the above mentioned components. Some of the indigenous benefits of the proposed system can already be highlighted:

✓ **Unique operational characteristics**, namely *efficient management of resources*, as well as the capability to *react quickly to changes* on the operational scenario.

✓ **State-of-the-art** technology

✓ **Proven concept**, as demonstrated by the performance of existing systems

✓ Potential to incorporate **additional features**, as required by the specific needs or communications policy of the user

✓ **User-friendly** operation with context sensitive help, definitely reducing training cycles and costs.

✓ Reduced **number of skilled operators** required

✓ **Distributed architecture** with indigenous high **survivability** and **reliability**

✓ **No single point of failure** at the system level

✓ **Modular** design

✓ **Flexible** configuration

✓ **Open system**, based on widely accepted standards and technology.

✓ Simple and **inexpensive maintenance**.

✓ **Inherent upgrade** capabilities

✓ Excellent **immunity to electromagnetic interference**

✓ **Reduced size and weight**, **minimum cabling**

1.1 System Description

1.1.1 FRONT-END UNITS

The front-end units provide the interface to the remote controlled equipment. The units with a height of 1U rack unit, adequate for 19" installation, house the hardware modules. The number of units depends on the specific system configuration.

A typical front-end unit includes, see Figure 1:

❑ Interface module

❑ AC/DC Power supply
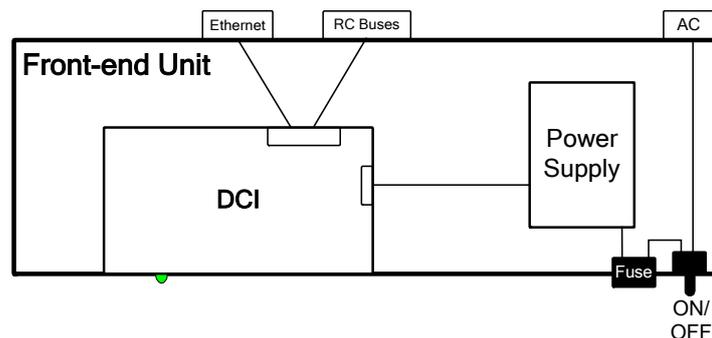
Figure 1 – Front-end unit block diagram

The *Data and Control Interface* (**DCI**), performs the remote control of equipment. Control commands issued by operators are routed to the **DCI**. In turn, the **DCI** provides the serial channels or buses that are connected to equipment remote control ports. Conversely, information coming from the remote controlled equipment is received by the **DCI** and from there conveyed to the **Management Terminal**. Besides serial and parallel ports, this module includes a 10BaseT Ethernet Interface for the Management Terminal connection. Digital I/O lines are also available for special purposes.

It should be noted that the application software, specific to each equipment, runs in the **DCI**. This means that all details regarding the particulars of a given equipment, namely the character string that needs to be sent to it, as well as its response, are hidden from the Management Terminal software. This solution is aimed at a maximum efficiency, minimising, at the same time, software configuration and up-grade efforts.

Continuous monitoring of the hardware status is performed within the unit, an alert or warning being generated whenever a fault is detected. Upon start-up, the various modules run a self-test program for detection of any malfunction. If any fault is detected, an alert message will be generated on the Management Terminal.

The ac/dc converter supply power to the unit from the ship's network (115 Vac). Each **DCI** module includes a dc/dc converter that transforms the external dc supply into the voltages required internally.

The figure below shows the front and rear views of a front-end unit.

Figure 2 – Front and Rear views

The specifications of the front-end unit are as follows:

Remote Control Interfaces .... RS-232/MIL-STD-188/RS-422, synchronous or asynchronous

Baud rate: configurable from 75 to 57600

Nº of stop bits: 1, 1.5, 2

Parity: none, odd, even

10 BaseT Ethernet according to IEEE 802.3

Power Supply .... 115/230Vac ± 10%, single phase, 47 to 63Hz

Operating temperature range .... 0 to 50º C

Humidity .... up to 95% non-condensing

1.1.2   MANAGEMENT TERMINAL

The **Management Terminal**, responsible for the overall system control and supervision, consists of a rugged computer with a 1280x1024 LCD monitor, keyboard and trackball, suitable for shipboard installation. Alternatively, a PC or Laptop can be used.

1.1.3   ARCHITECTURE

The system control structure is shown in Figure 3. The number of front-end units is defined taking into consideration the quantity and diversity of interfaces required by the system configuration.

The Management Terminal(s) is connected to the Front-end units through an Ethernet link.

In terms of equipment remote control, the **Front-end units** include one **DCI** module that generate the serial data channels or buses, which in turn are connected to the equipment control ports.
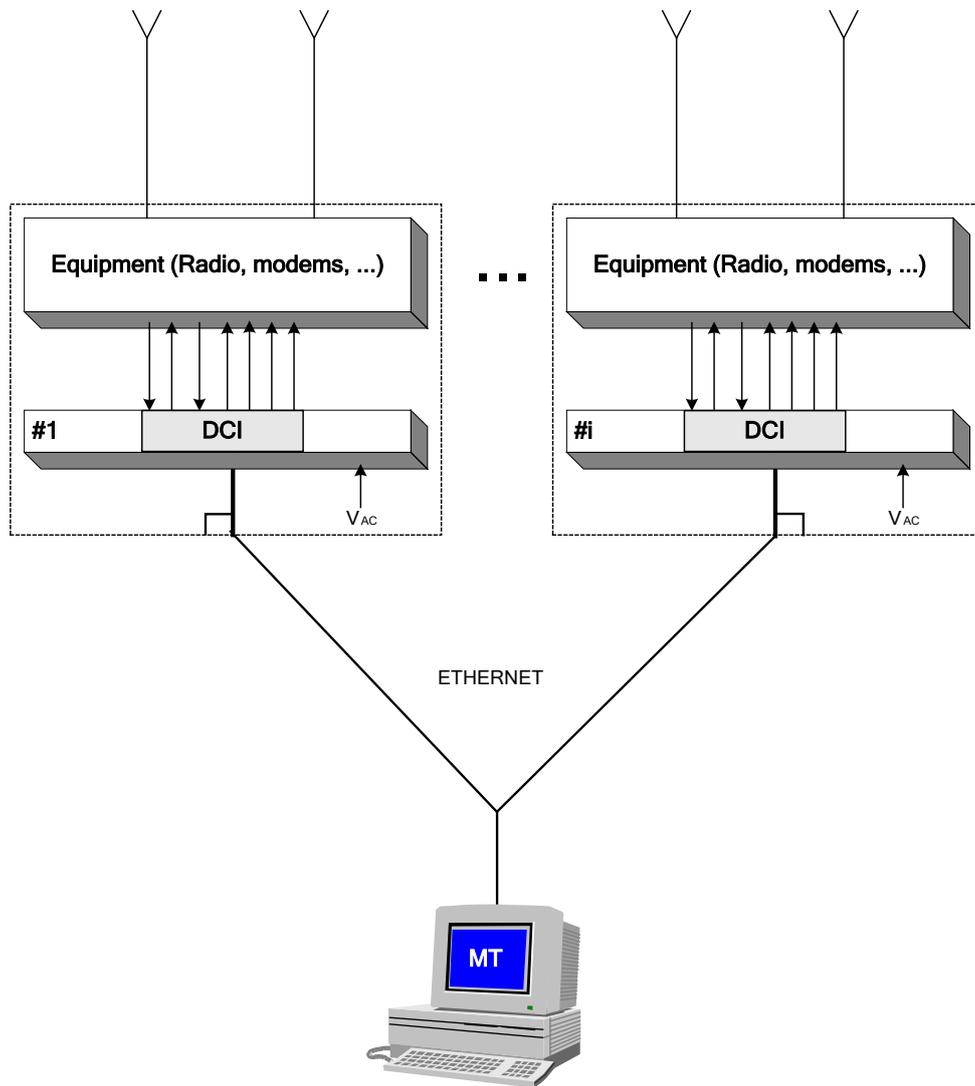
Figure 3 - ERCS Block Diagram

1.2 Functional Aspects

1.2.1 REMOTE CONTROL

The system control scope is only limited by the remote control capabilities of each specific type of equipment. In general, it is possible to remote control quite a diversity of equipment functions. A continuous, real-time monitoring of the equipment status is also automatically performed, enabling fault detection of each and every equipment.

The typical functions under system control for a HF transceiver are listed in Table 1.

As already stressed, the functions associated with remote control are assigned to the Management Terminal operator. These functions may however be dynamically entrusted to dedicated remote control units, installed in ship's operational areas such as the operations room. This is particularly useful when, for operational reasons, users need to have direct control of the particular radio that they are using.

Table 1 - HF transceiver remotely controlled parameters

Command	Function	Range/Values	Remarks
FREQUENCY	Sets operating frequency	Rx: 10 kHz - 30 MHz,Tx: 1.5 – 30 MHz	1 Hz step
MODULATION	Sets operation mode and FSK/AFSK parameters, when applicable	AME, USB, LSB, FAX, CW, FSK, AFSK, FM, USB(Rx)/LSB(Tx), LSB(Rx)/USB(Tx), ISB	
	Frequency shift	±42, ±85, ±225, ±425 Hz	FSK/AFSK only
	Baud Rate	50, 75, 100, 150, 300, 600 baud	FSK/AFSK only
	Polarity	Normal/Reverse	FSK/AFSK only
	Frequency offset	-5000 to +5000 Hz	AFSK, 1 Hz step
BANDWIDTH	Sets IF selectivity	150, 300, 600, 1000, 1500, 2100, 2400, 2700, 3100, 6000 and 8000 Hz	FM: 6 or 8 kHz; FSK, AFSK, FAX, SSB and ISB: 3100 Hz
GAIN CONTROL	Selects automatic or manual gain control	AGC: ON, OFF MGC: 0 to 126 dBµV	1 dBµV step
DECAY TIME	Sets AGC decay time	25,150,500,1000,3000 ms	
PREAMPLIFIER	Switches preamplifier on and off	ON, OFF	
SQUELCH	Switches squelch function on and off	ON, OFF	AME, FM, SSB and ISB only
POWER LEVEL	Sets output power level	Receive only, Low/Medium/High	
TUNE	Initiates tuning process		
RECALL	Activates a preset channel	Half-duplex: 0 to 99 Simplex: 100 to 400 ITU: 401 to 2240	
STORE	Stores current settings into a channel	Half-duplex: 0 to 99 Simplex: 100 to 400	
BFO	Sets BFO frequency	-5000 to +5000 Hz	10 Hz step; CW, FAX, FSK and AFSK modes only
CHANNEL CONTENTS (VIEW)	Inquiry of channel contents		
CHANNEL PROGRAMMING	Programs contents of half-duplex preset channels (0 to 99)	Rx and tx frequency, modulation, BFO, bandwidth, power level, preamplifier, voice compressor	Ranges as per individual commands
	Programs contents of simplex preset channels (100 to 400)	Frequency, modulation, BFO, bandwidth, power level, preamplifier, voice compressor	Ranges as per individual commands
BIT	Initiates built-in test		
VOX	Switches voice-operated modulation on and off	ON, OFF	AME, SSB and ISB modes only
NOTCH FILTER	Sets notch filter frequency or switches filter off	-5000 to +5000 Hz	10 Hz step
VOICE COMPRESSOR	Switches voice compressor on/ off	ON, OFF	SSB modes only

1.2.2 CONTROL AND SUPERVISION

The **ERCS** control software that runs in the **Management Terminal** enables the Operator to perform the following:

- ❒ Access control and password management

- ❒ Define users profile

- ❒ Equipment remote control

- ❒ Pre-program actions to be executed automatically

- ❒ Continuous monitor the system status

- ❒ Inspect logged events

- ❒ Configuration control (check software and firmware versions)

1.3 Human-Machine Interface

In general terms, the Human-machine interface software - supported on a windows-based graphical user interface - will give the operators access to all **ERCS** working parameters, so that appropriate actions can be taken as required. By taking care of all aspects of the system operation that can be automated, and providing helpful suggestions whenever the opportunity arises, the operator's job is greatly simplified.

1.3.1 MANAGEMENT TERMINAL

1.3.1.1 SYSTEM START-UP / ACCESS CONTROL

ERCS is protected against unauthorised use by keeping track of its operators and associated passwords. If the correct name and password are not given during the LOGIN process, the system will not accept further commands.

1.3.1.2 OPERATORS MANAGEMENT

For the purpose of access control, the system includes facilities to view, add and remove operator names and associated passwords. The maximum number of operators is a system configuration.

The system supports several operator access levels. A typical configuration has two access levels, one for operators and another for supervisors:

> **Access level 0** - operators have only access to the basic operations.

> **Access level 1** - supervisors have access to each and every system feature.

The main difference between levels 0 and 1 is the capability to add/remove operators to/from the system.

Passwords shall be changed periodically. When the password expires, the operator is asked to change it. If he fails to do so, access is denied.

1.3.1.3   MAIN WINDOW

After the start-up phase, the system opens the Main window and the respective Login access control window, providing an overview of the system status. After successful login the user has access to the complete system functionality.

Figure 4 illustrates a typical HFBB remote control window.
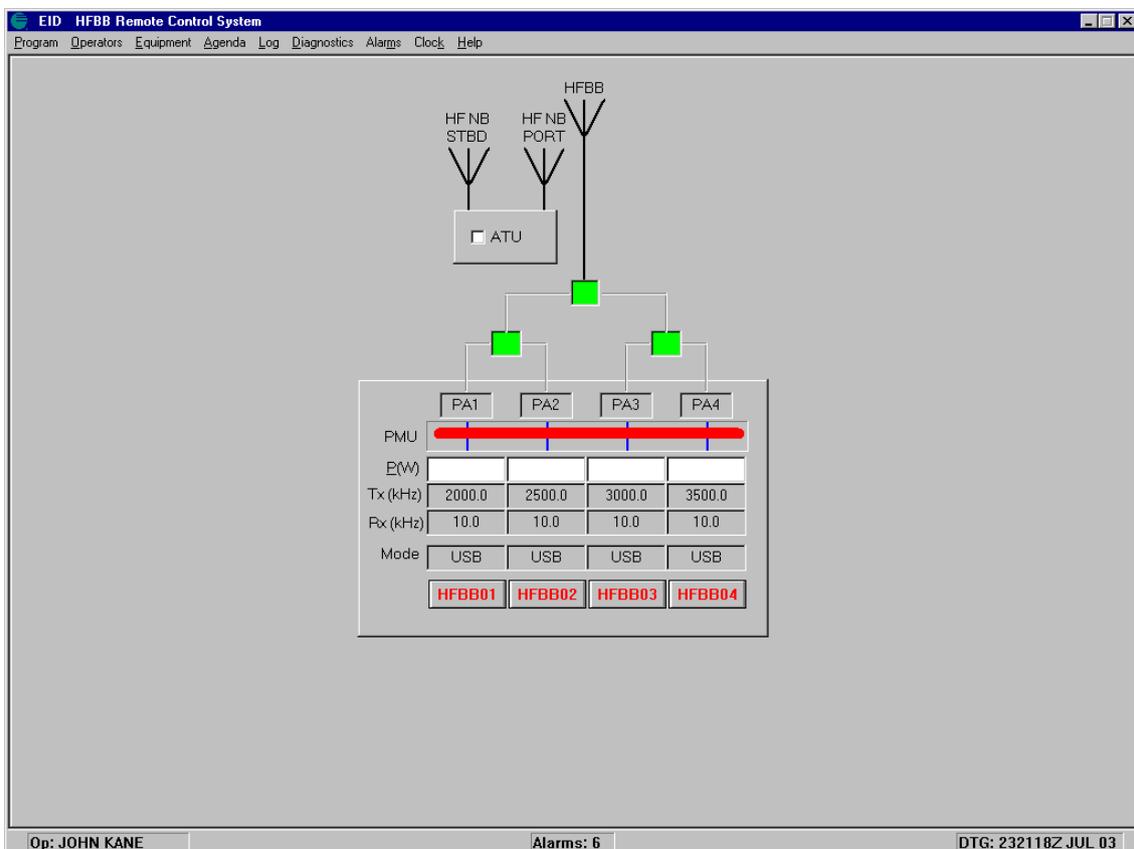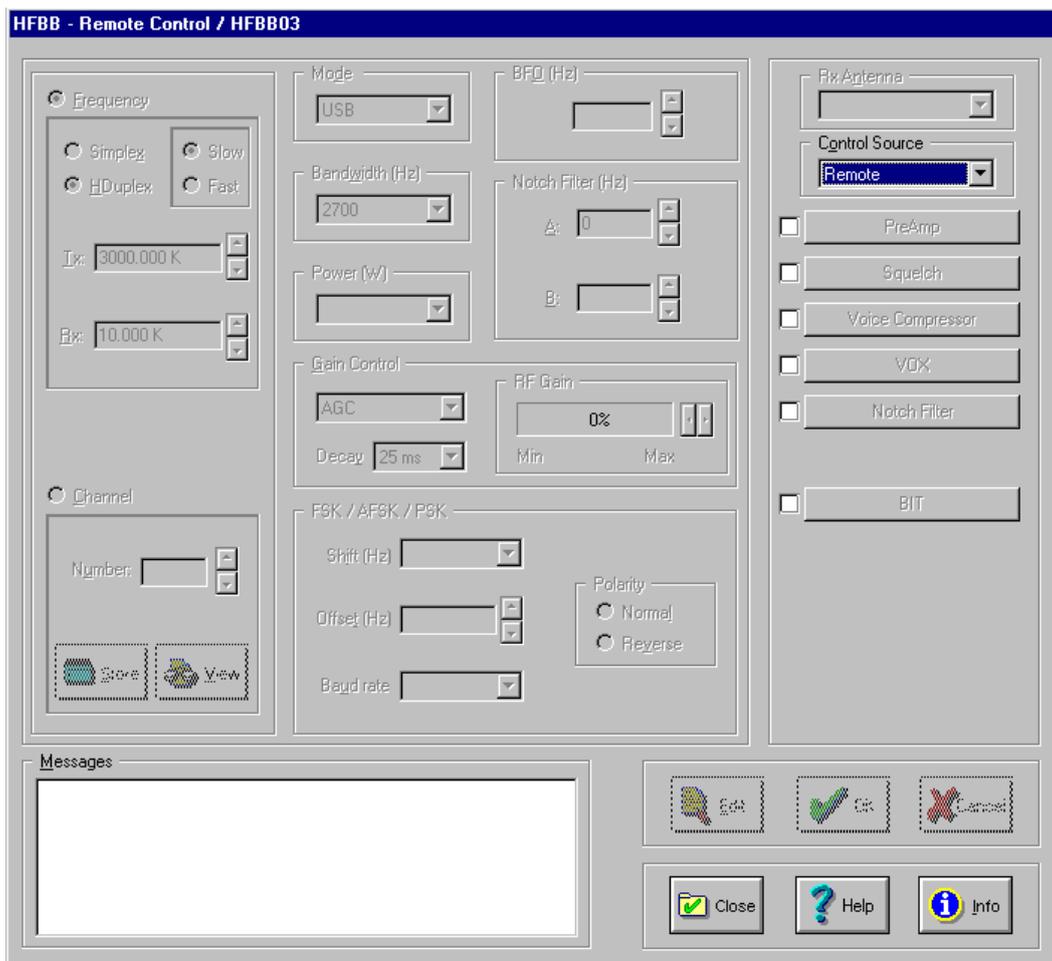

Figure 4 – Main Window

The information elements displayed in the Main window central area are as follows:

- ❑ Full picture and status of the system

- ❑ Name of the current operator.

- ❑ Number of pending alerts.

- ❑ Date-time group.

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Besides all this information, this window enables the operator to remote control the pieces of equipment. For instance, if the operator clicks on HFBB03, access to the corresponding remote control window will be given, see Figure 5.

Figure 5 – HFBB03 Control Window

A brief description of the main window menus is provided below.

The **Program** menu includes the following commands:

Logout - This command makes it possible to change operators without leaving the program.

Exit - You select this option to terminate program execution. This command opens the Exit window, which includes only two buttons: **OK** and **CANCEL**.

About - This will show you the *credits screen:* the program name and release, copyright notice and part number.

The **Operators** menu includes the **Change password** and **Set-up** commands. The former will let you change your password by opening the **Operators/Change Password** window. The latter, only enabled if you have level 1 privilege, opens the **Operators/Set-up** window, letting you add and remove operators from the system.

The **Equipment** menu has the **History** and **Equipment Versions** commands. The first lets you access the equipment management facilities that will show you the changes that occurred in equipment status. The former gives for all and every remote controlled equipment the following data:

– remote controlled equipment firmware version.

– equipment firmware version(s) supported by the ERCS remote control software.

The **Agenda** menu has only the **View** command. If you select this menu command, the system will get you into the **Agenda** window where you have access to the Agenda features.

The **Log** menu includes the **View** command, through which you have access to the Log features, whereby you can view all the recorded events.

The **Alerts** menu includes the **View** command, which opens the **Alerts** window. It will show you all the pending alerts in the system. If there are no alerts this command is disabled. Additionally the **Notify** command enable/disable the automatic view of the alert messages, whenever an alert occurs.

The **Clock** menu, through the **Set-up** command, opens the **Clock/Set-up** window that will enable you to change the system time and date.

An on-line help is available at every window of the **ERCS**, providing a context help.

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