

JAERI-M
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CASDAC SYSTEM
- DATA TERMINAL EQUIPMENT -
USER'S GUIDE

March 1993

Yoichi YAMAMOTO and Kinji KOYAMA

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CASDAC System
- Data Terminal Equipment -
User's Guide

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The CASDAC (Containment And Surveillance Data Authenticated Communication) system has been developed by JAERI for nuclear safeguards and physical protection of nuclear material. This system is a remote monitoring system for continual verification of security and safeguards status of nuclear material.

The CASDAC system consists of two subsystems, one of them is a Grand Command Center (GCC) subsystem and the other is a facility subsystem.

This report describes the outline and usage of the Data Terminal Equipment (DTE), which makes available of message data communication between the GCC and a facility subsystem. This work has been carried out in the framework of Japan Support Programme for Agency Safeguards (JASPAS) as a project, JA-1.

Keywords : CASDAC, Safeguards, Physical Protection, System, Verification, C/S (Containment/Surveillance), DTE

CASDAC システム
— データ端末装置 —
使用者の手引き

日本原子力研究所東海研究所燃料安全工学部
山本 洋一・小山 謹二

(1993年2月15日受理)

CASDAC (封じ込め/監視データ認証通信) システムは、保障措置及び核物質防護の一環として日本原子力研究所が開発した。このシステムはRECOVERシステムとTRANSEAVARシステムを基に、改良RECOVERシステムとして設計、製作された、核物質の保全状況及び保障措置状況の検認を行うための遠隔監視システムである。

本システムは、2つのサブシステムからなり、1つは中央監視センター (GCC)、他の1つは施設サブシステムである。

本報告書は、施設サブシステムと中央監視センターとの間のメッセージデータ通信を可能にしているデータ端末装置 (DTE) について、その概要及び使用方法についてまとめたものである。なお、本研究は日本国のIAEA保障措置支援計画の一環としてプロジェクトJA-1として実施したものである。

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1. Outline of CASDAC System

The CASDAC (Containment and Surveillance Data Authenticated Communication) system [1] is a secure and reliable communication system which continually monitors any changes in the status of containment and surveillance sensors and the status of integrity and health of the system itself.

Communication data must be secure and reliable, therefore all the data on public telephone line network are encrypted to prevent falsification and tapping by unauthorized persons, and the high level data link control (HDLC) procedures are adopted to detect tampering with the data or unauthorized polling trial through public telephone line. The system configuration is shown in Fig. 1.

The system is designed to realize requirements of secure communication, very low false alarm rates and of unattended operation of the facility subsystem. Together with these requirements, cost performance, easy maintenance and transportability of software system including the application programs are also important factors considered.

The system is divided into two subsystems, one is the Grand Command Center (GCC) system and the other is the facility subsystem including containment and surveillance sensor (C/S) system. The communication between two subsystems is controlled by means of a tamper resistant and secure way through the international public telephone line network.

The GCC system consists of two engineering workstations with graphic terminals and two communication control equipments (CCE).

The facility subsystem consists of: 1) The On-Site Multiplexer (OSM) composed of a personal computer, a modem, two HDLC boards, and a monitoring unit adapter (MU-ADP) which is designed for this system specially to make communication available between OSM and MUs (up to 30 MUs), 2) A set of the Monitoring Units (MU), which can monitor up to 8 bits binary (on/off) signals from C/S sensor, 3) The Data Terminal Equipment (DTE) for making message communication available between the GCC and the facility subsystem by a classified and secure way, which also consists of a personal computer with 40 M bytes hard-disk and a HDLC board, and 4) The Multiplexer Unit (MXU) which can link with computer controlled devices such as the global positioning system (GPS) and the satellite communication control equipments.

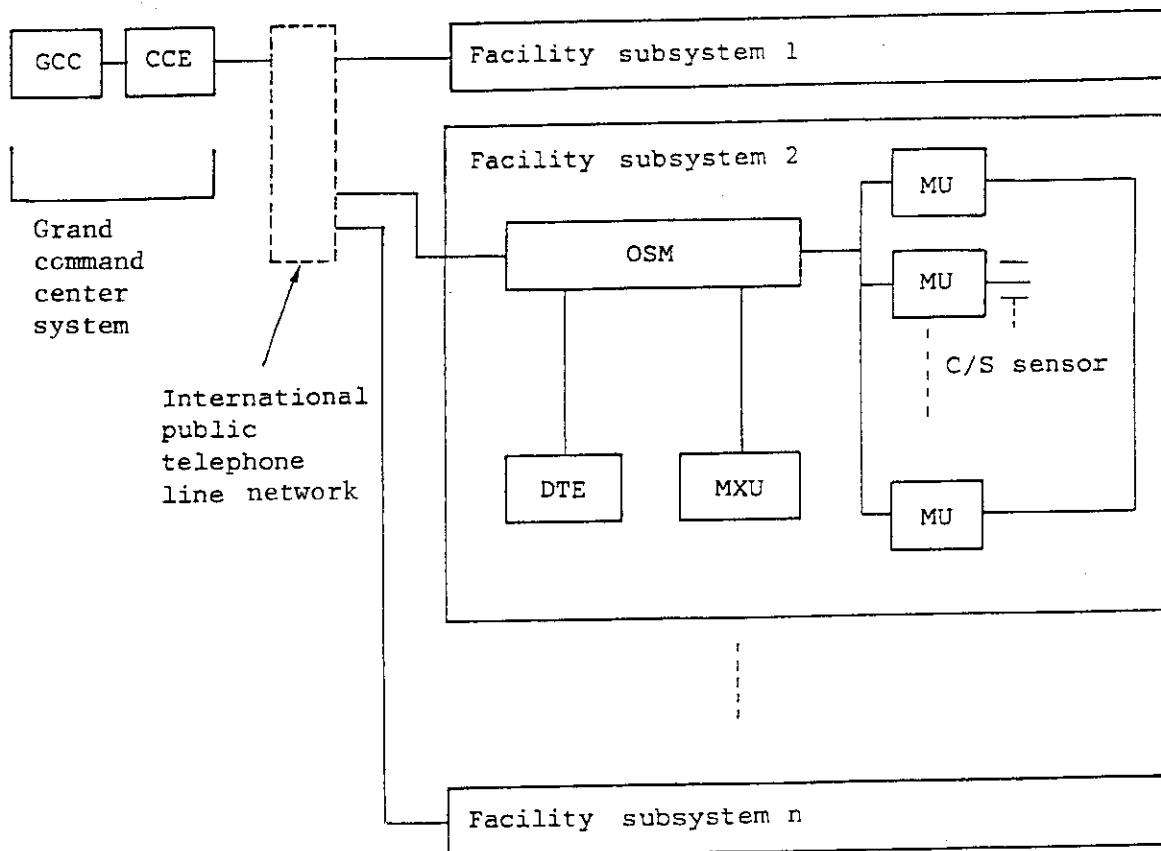


Fig. 1 Configuration of CASDAC System

2. Outline of Data Terminal Equipment(DTE)

The DTE is a terminal to make available of message data communication between the GCC and a facility subsystem, and can be installed near an OSM at a monitored facility.

This message data communication must be only allowed by the authorized person to transmit a message from the DTE to the GCC or vice versa.

The message must be in an ASCII file with minimum control characters such as Nondocument Mode of WordStar, and the file length is limited up to 8K bytes, which can be provided on an editor or word-processor.

The received message file is stored automatically in the hard disk with its own file name. This file name contains double figures that is updated by the way of changing cyclically from 01 to 64 (up to 64 files are stored in the hard disk), and of which the contents can be reviewed on the display monitor of the DTE.

For data security concerns, the accesses to the DTE system to make available of message data communication is limited by means of passwords, but not to Word Star (Ver.4) installed into the hard disk. And all the message data on the communication line are encrypted between OSM and GCC.

3. Hardware of DTE

The DTE is composed of a standard personal computer (PC9801 VM11) with a 40 M bytes hard disk and a HDLC (High level Data Link Control) board. The general specifications of DTE are summarized in Table 1. The configuration and the hardware block diagram of DTE are shown in the figures 2 and 3 respectively.

The DTE is connected with the OSM via the X.21 serial interface port on the HDLC board, and makes available of message data communication with the GCC via the OSM. The specifications of the serial interface port are shown in Table 2.

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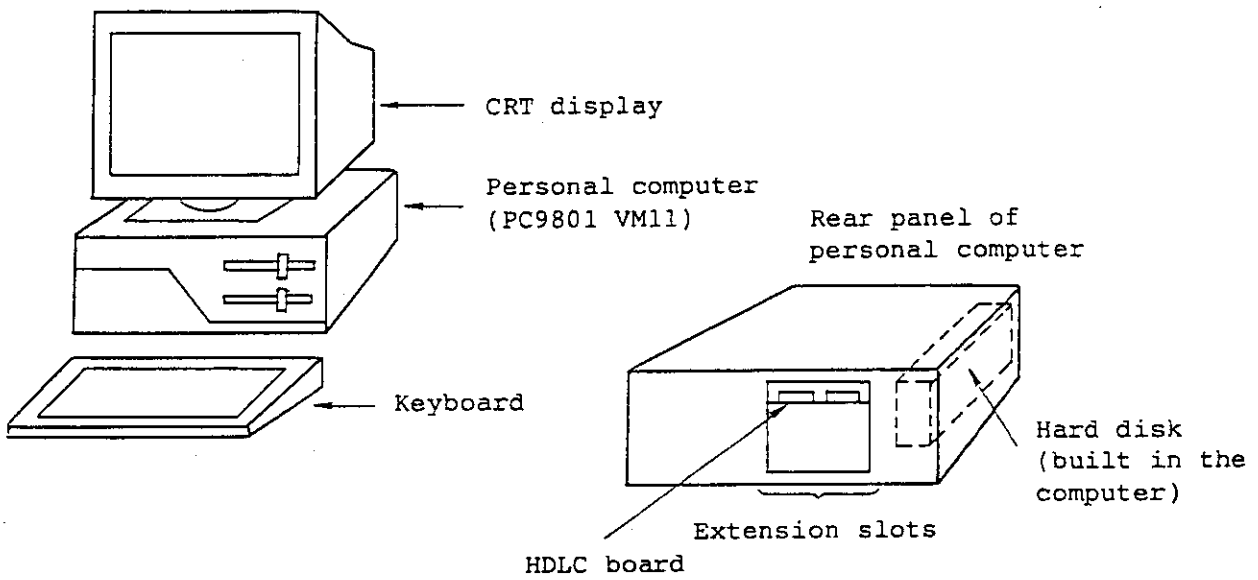


Fig. 2 Configuration of DTE

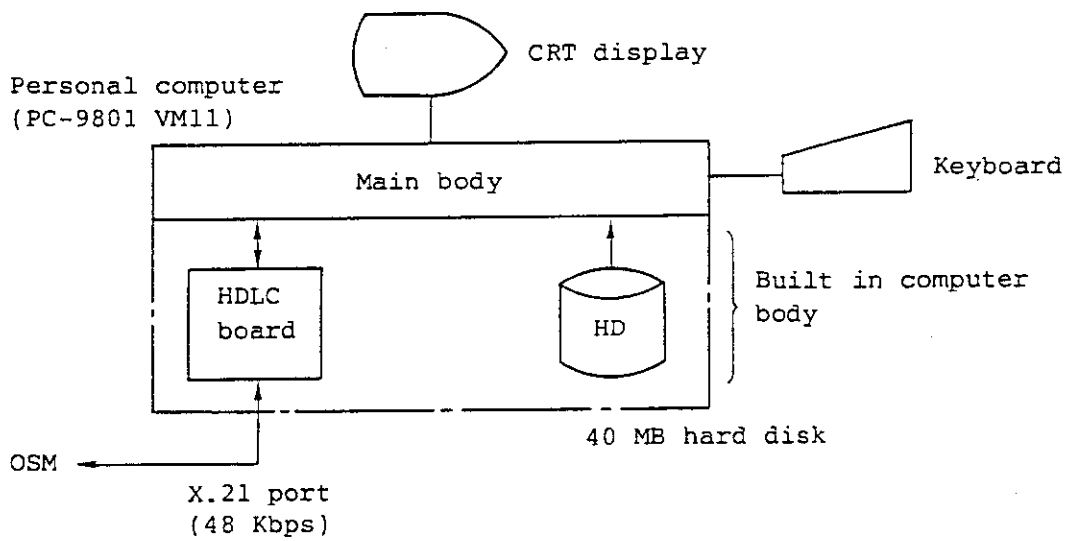


Fig. 3 Hardware Block Diagram of the DTE

Table 1. General Specifications of DTE

Item		Specifications
Supply voltage		100 VAC \pm 10% (50/60 Hz)
Power consumption		Max. 180 W (Note)
Environmental conditions	Temp.	0 to 40° C
	Humidity	30 to 80%

Note: including CRT display power consumption

Table 2. Communication Line Interface with OSM

Item	Specifications
Electric & physical standard	Compliant with CCITT X.21
Communication type	Full duplex
Communication speed	48 Kbps
Transmission control procedure	HDLC-ABM
Code error detection	CRC-CCITT ($X^{16} + X^{12} + X^5 + 1$)

4. Communication with the OSM

The DTE transfers messages between the DTE and the GCC via the OSM. When the OSM receives a request to send message from the DTE, it connects the line with the CCE, checks the status of the line between the GCC and the OSM, and transmits DTE's message data to the GCC. Likewise, when the OSM receives a request to send message from the GCC, it transmits GCC's message data to the DTE. Fig. 4 shows the sequence of message transfer between DTE and GCC.

5. Operation

5.1 Initial Setting of Hardware Switches

There are some switches in the DTE hardware of which the parameters must be set properly so as to match with the operation condition. If these settings are not proper, the DTE cannot work properly.

All the parameters have been set properly before shipment. No user needs any changes of settings. The list of parameters, which must be set, is given in Table 3 for easy confirmation of them. The arrangement of switches on the HDLC board (PC-COM board) is shown in Fig. 5.

5.2 Cable Connection

Connect the attached cable "LCBL2" to the 15-pin connector on the HDLC board mounted into the extension bus slot of the DTE and the DTE connector on the OSM as shown in Fig. 6.

5.3 Starting System

The DTE system starts its operation through the following steps:

- (1) Turn on the PC-9801 VM11 (or press the reset button if power is already supplied to it).
- (2) A setup menu is displayed automatically on the screen as shown in Fig. 7.
- (3) Select the number 1 (press '1' key) to start the system for making available of message communication with the GCC.
- (4) When "PASS WORD =" is displayed on the screen, then enter the

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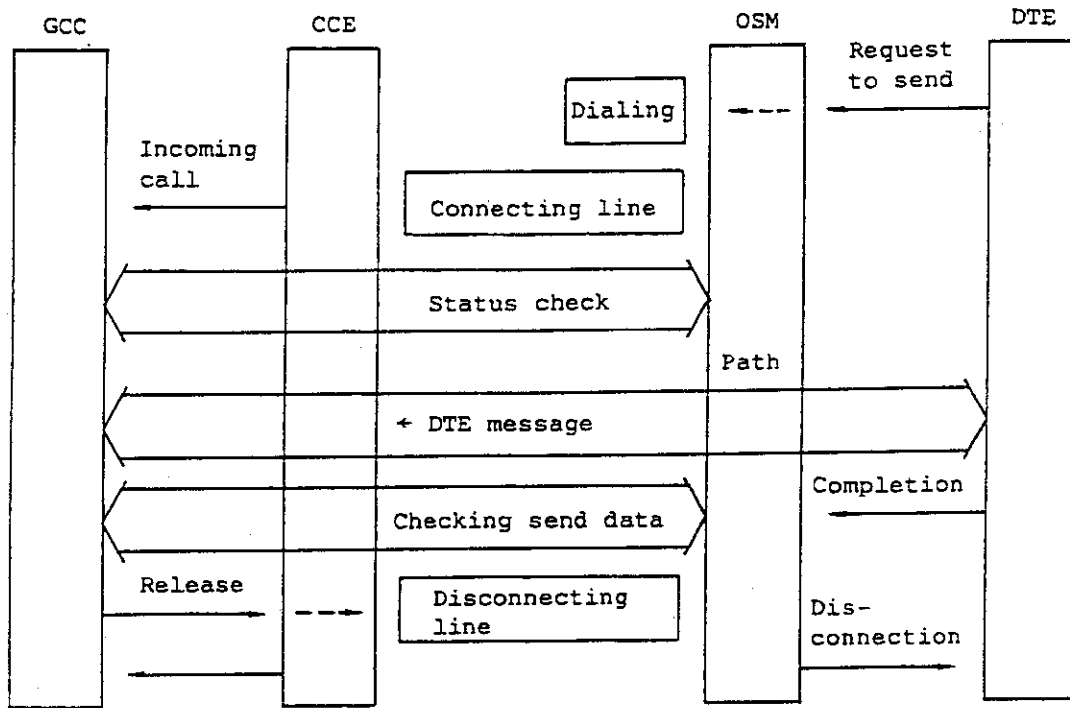
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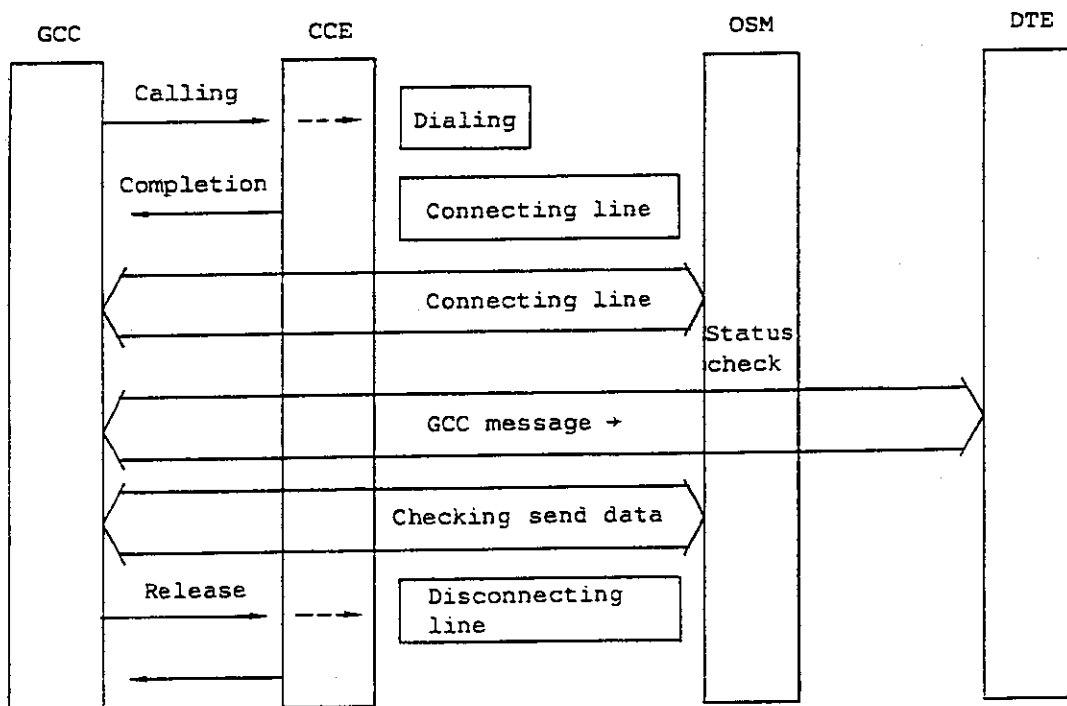
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- (4) When "PASS WORD =" is displayed on the screen, then enter the



(a) DTE --> GCC



(b) GCC --> DTE

Fig. 4 Outline of Message Transfer between DTE and GCC

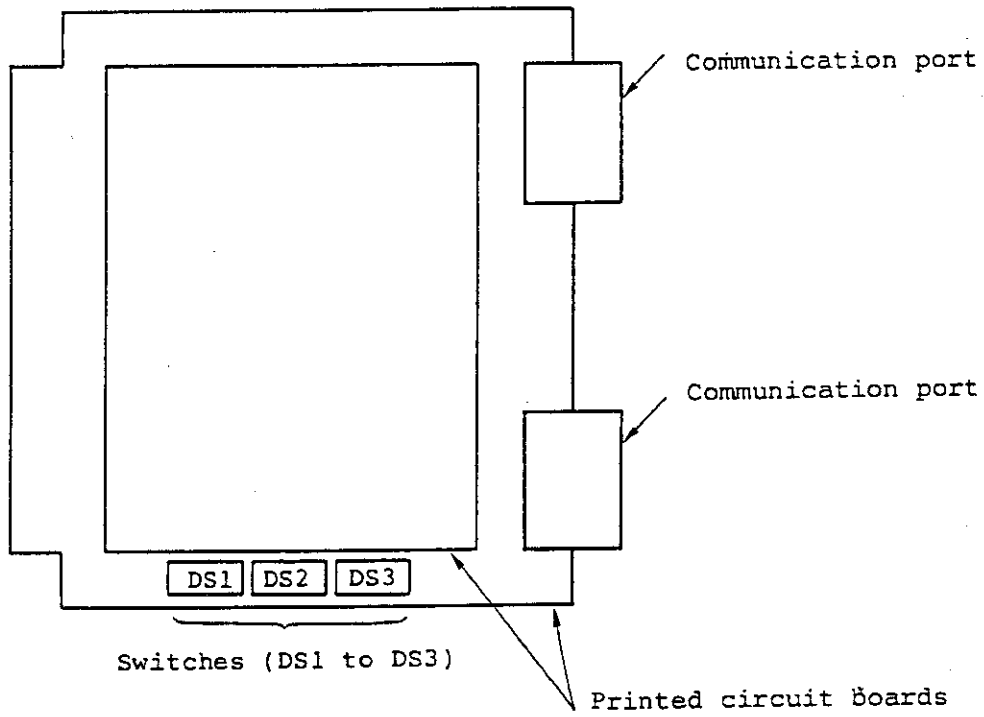


Fig. 5 Switch Layout on HDLC Board

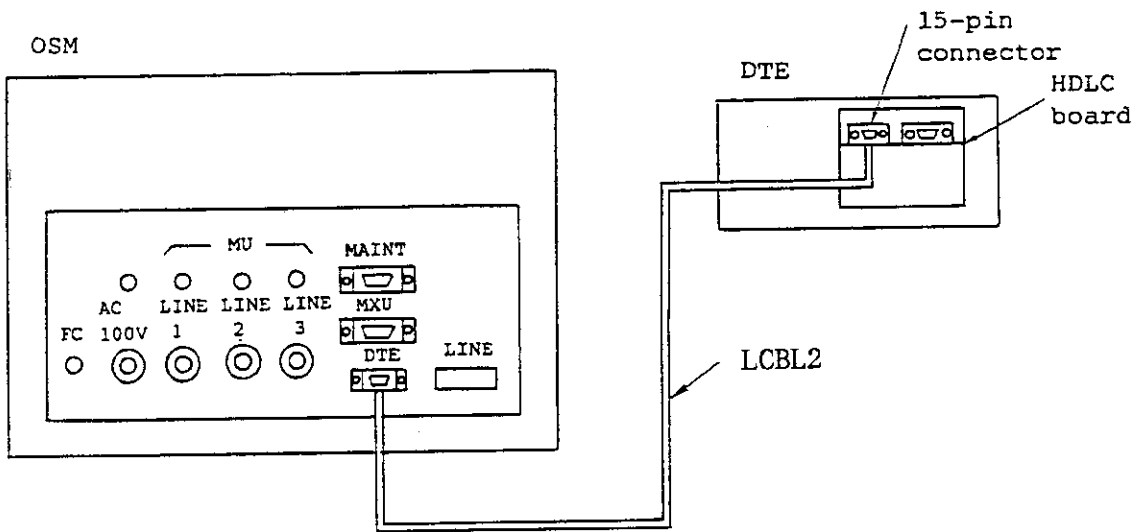


Fig. 6 DTE Cable Connection with OSM

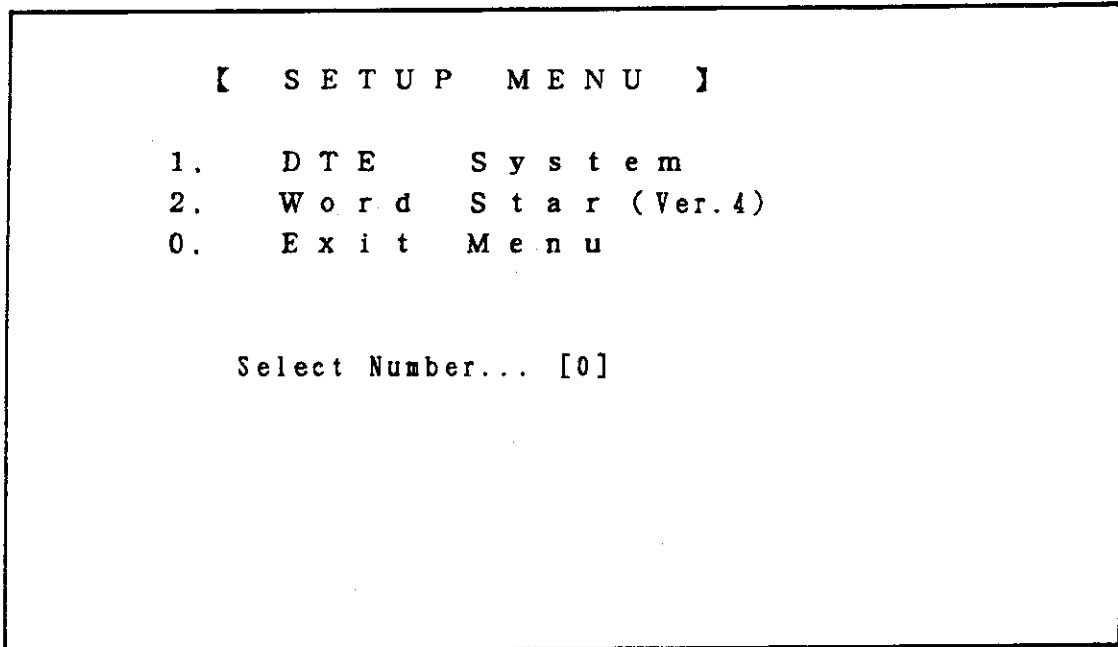


Fig. 7 SETUP MENU on the CRT Display

Table 3. Parameter List

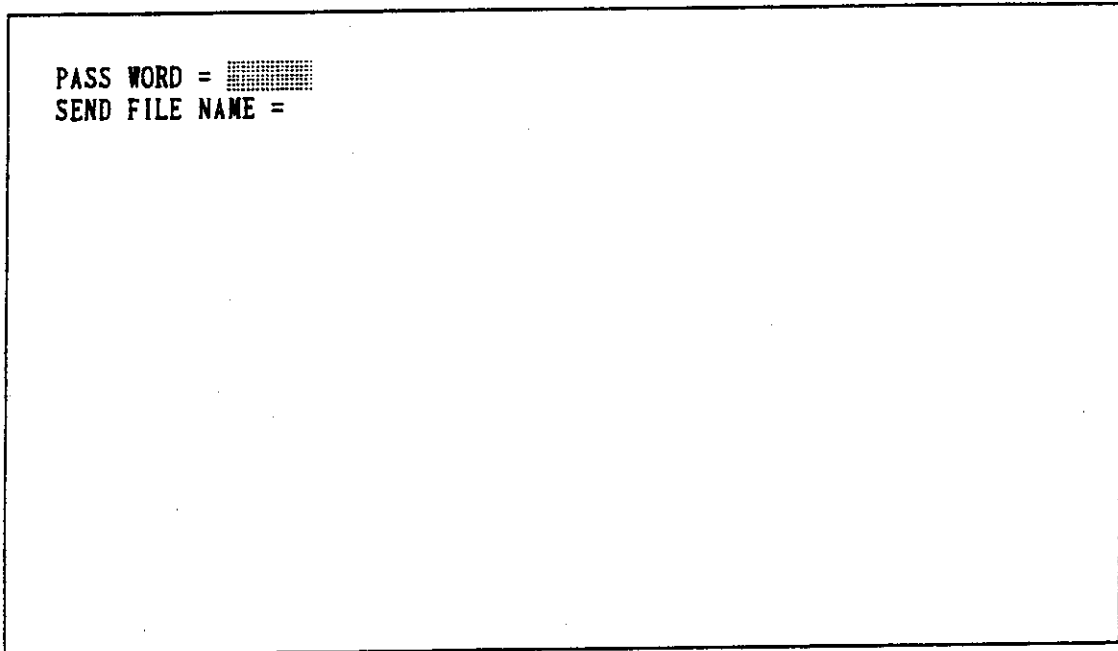
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password.

(5) Password check

- (a) If the entered password is valid,
"SEND FILE NAME =" is displayed on the screen and the system starts up and is ready for communication with the GCC.
(See Example 1 for password input.)
- (b) If the entered password is invalid,
It will be rejected by the system, then the system comes back to the setup menu automatically.

<Example 1> The system starts up, when a proper password is entered



Note: The shaded part indicates the area of an entered password. The entered password is not displayed on the screen.

6. Message Transfer Procedures

6.1 Message Transmission to GCC

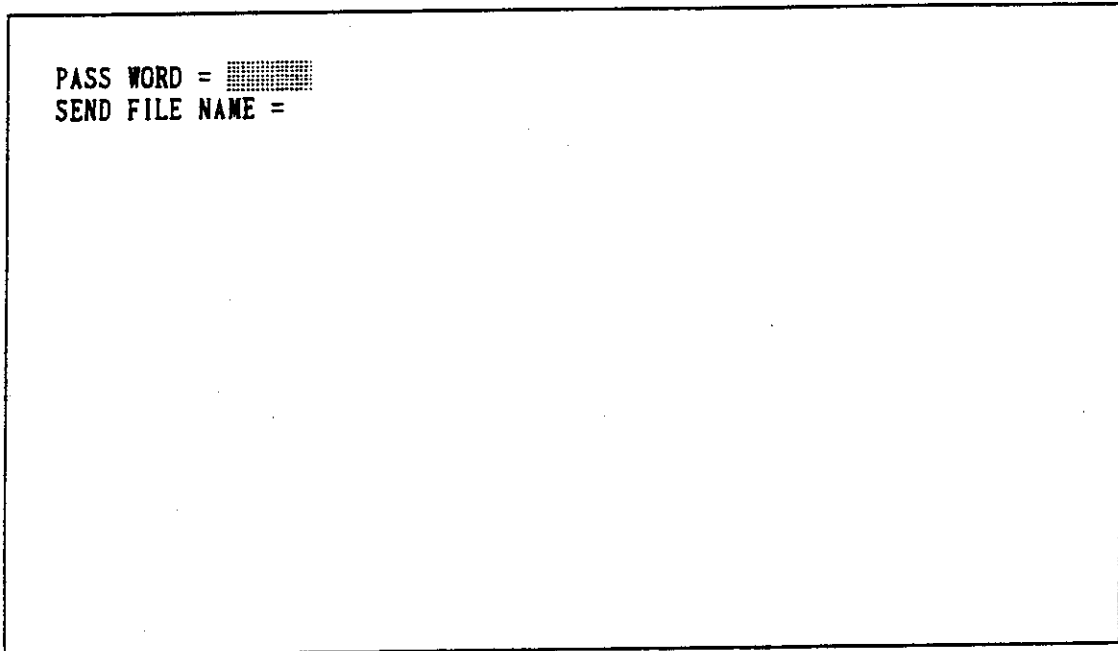
Messages are transmitted to the GCC in accordance with the following steps:

password.

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Note: The shaded part indicates the area of an entered password. The entered password is not displayed on the screen.

6. Message Transfer Procedures

6.1 Message Transmission to GCC

Messages are transmitted to the GCC in accordance with the following steps:

(1) Initial screen
Make sure that "SEND FILE NAME =" is displayed on the screen.

(2) File name input
Enter a file name as follows:

```
SEND FILE NAME =*****  
                File name
```

Up to 12 characters (including 3 characters for file type) can be used for a file name.

(3) Press "RETURN" key to define the file name
Response of the system is any of the following four:

(i) If a proper file name is entered (See Example 2)

"MESSAGE SEND START!"

is displayed, and the message transmission procedure is just started.

<Example 2> If a proper file name is entered
(File name:ABCD.MSG)

```
SEND FILE NAME = ABCD.MSG  
MESSAGE SEND START!
```

⋮ is operator input part.

- (ii) If an invalid file name is entered (See Example 3)
The following error message is displayed, and the DTE system asks for reentering a proper file name.

```
"FILE NAME ERROR"  
"SEND FILE NAME="
```

<Example 3> If an invalid file name is entered
(Invalid file name: AAA.MSG)

```
SEND FILE NAME = AAA.MSG  
FILE NAME ERROR  
SEND FILE NAME =
```

■ is operator input part.

- (iii) If the file size exceeds 8064 bytes,
The following error message is displayed, and the DTE system asks for reentering a proper file name.

```
"SEND FILE LENGTH OVER!"  
"SEND FILE NAME="
```

- (iv) In case of time-out,
If no response is given by the OSM in spite that an entered file name is valid, the following error message is displayed, and the DTE system asks for entering a next file name.

```
"TIME OUT"  
"SEND FILE NAME="
```

(4) Starting message transmission

"MESSAGE SEND START!"
"MESSAGE DATA SENDING 01" (Note)

The above shows the status to be now sending the packet number of the message data. The packet number displayed is in the range from 01 to 64.

Note: The packet number denotes a serial number given to each packet with 128-byte length.

(5) Completion of message transmission

(i) Normal end (See Example 4)

The following message is displayed:

"NORMAL END"
"SEND FILE NAME="

<Example 4> If a message of 3 packets in length is transmitted properly.

```
SEND FILE NAME = ABCD MSE  
MESSAGE SEND START!  
MESSAGE DATA SENDING 01  
MESSAGE DATA SENDING 02  
MESSAGE DATA SENDING 03  
NORMAL END  
SEND FILE NAME =
```

■■■■■ is operator input part.

(ii) Abnormal termination (See Example 5)

(a) The following error message is displayed:


```
"ABNORMAL END"  
"SEND FILE NAME="
```


Then, try again for the message transmission.

(b) If processing discontinues due to time-out,
the following message is displayed:

```
"TIME OUT"  
"ABNORMAL END"  
"SEND FILE NAME="
```

<Example 5> If the GCC sends no response "ACK" to the OSM for the 1st packet, resulting in time-out error in the OSM.

```
SEND FILE NAME =   
MESSAGE SEND START!  
MESSAGE DATA SENDING 01  
TIME OUT  
ABNORMAL END  
SEND FILE NAME =
```

 is operator input part.

6.2 Reception of Message from GCC

Messages from the GCC are received in accordance with the following steps:

(0) Ready for message reception

The system must be ready for message reception, this means that the system is at the situation that message transmission is available as shown in <Example 1>.

(1) Starting message reception

When "MESSAGE RECEIVE PROCESS START" is displayed on the screen, a message is being received from the GCC.

(2) During message reception

```
"MESSAGE RECEIVE PROCESS START"
"MESSAGE DATA RECEIVING 01" (Note)
"MESSAGE DATA RECEIVING 02"
```

```
:
:
```

The above shows the tracking of message reception and packet number when a message data is being received from the GCC.

Packet number is initiated from 01 and is in the range within 64.

Note: The packet number denotes a serial number from 1 to 64 assigned to each packet with 128-byte length in ascending order.

(3) Completion of message reception

(i) Normal end

Received message is filed into the hard disk; (see Example 6)

```
"NORMAL END & FILE No.=**" (Note 2)
```

The above shows the normal end of the message reception and file number by **.

Note 2: The file number denotes a number given to a file where received message is stored. Numbers from 01 to 64 are given to files in sequence. The file number next to the 64th file is given as 01 again. Note that the old

file 01 is erased.

(ii) Reception of message over 8064 bytes

```
"RECEIVED MESSAGE SIZE OVER!"  
"NORMAL END & FILE No. = **"
```

The above shows the error message and the normal end message with the file number. The received message up to 8064 bytes are stored into the file, but not into the file over 8064 bytes of the received message.

Note: When a received message is stored in a file, the file is named as "RCV**". "**" shows a file number.

<Example 6> If a message of 4 packets in length is received properly and a file named "RCV01" is created properly

```
SEND FILE NAME =  
MESSAGE RECEIVE PROCESS START  
MESSAGE DATA RECEIVING 01  
MESSAGE DATA RECEIVING 02  
MESSAGE DATA RECEIVING 03  
MESSAGE DATA RECEIVING 04  
NORMAL END & FILE No. = 01  
SEND FILE NAME =
```

(iii) Abnormal termination (See Example 7)

The following error message is displayed:

```
"ABNORMAL END"  
"SEND FILE NAME="
```

Then, try again for the message transmission.

If the communication line is released due to time-out, the following message is displayed before the above message is displayed:

"TIME OUT"

<Example 7> If the response "ACK" from the GCC for the 3rd packet cannot be received after receiving the 2nd message packet, resulting in time-out.

```
SEND FILE NAME =  
MESSAGE RECEIVE PROCESS START  
MESSAGE DATA RECEIVING 01  
MESSAGE DATA RECEIVING 02  
TIME OUT  
ABNORMAL END  
SEND FILE NAME =
```

Note: If operation is suspended, the received message is abandoned.

6.3 How to quit Message Transfer Mode

While the initial screen is displayed (i.e., "SEND FILE NAME =" is displayed on the screen), pressing the "ESC" key quits the message transfer mode of the DTE system, then the system returns to the setup menu automatically.

6.3.1 Line Fault Recovery Procedure

If a line fault (including OSM system down) occurs in spite that a message is being transmitted or received or the system is under the wait-for-reception condition, you must quit the system and restart the DTE system.

In this case, press the reset button or "ESC" key to restart the system.

References

1. Y. YAMAMOTO and K. KOYAMA: "Upgraded RECOVER System - CASDAC System -", JAERI-M 92-026, JASPAS 91-2 (1992).

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References

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