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Title:

Terminal Access Module (TEM) (3rd Edition)
User's Guide/Reference Manual/Installation Guide

A/S REGNECENTRALEN af 1979

Keywords:

RC8000, RC4000, monitor, terminal access, multiplexing, spooling.

Abstract:

TEM is a service module, which on behalf of applications supports accessing of terminals.
This manual contains information of interest for the application programmer, the operator and the system staff.

(46 printed pages)

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FOREWORD

First edition: RCSL No 31-D481.

Second edition: RCSL No 31-D513.
The manual describes revision 2 of the terminal access module TEM.

No differences in functions and formats have been made, but new facilities have been implemented. The extensions concern mainly interface functions to the format 8000 system.

The TEM system has been designed and implemented by the authors.

This manual replaces the description of revision 1, January 1978.

Niels Møller Jørgensen
A/S REGNECENTRALEN, October 1978

Third edition: RCSL No 31-D689.
The manual describes revision 3 of the terminal access module TEM.

TEM has been extended with new facilities for format 8000 device control messages implemented in IBM 3270 Terminal Handler version 2 and entering of passwords in nondisplay mode as implemented in Basis system (SW8001/1 release 4.2 and SW8001/2 release 1).

The changes are indicated by correction lines in left margin.

This manual replaces the description of revision 2 (RCSL No 31-D513).

Flemming Biggas
A/S REGNECENTRALEN af 1979, March 1983

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1. INTRODUCTION 1.

This manual contains information about the service module TEM.

Relevant information may be found by people, who are going to use, install, generate or work as operators for TEM.

The purpose of TEM is to support access of terminals. TEM aims specifically at multiplexing of terminal input and output to and from an application. In addition TEM offers spooling of data in order to smooth speed differences between an application program and (slow) external devices.

The facilities of TEM will make programming of on-line systems easier, because TEM allows an application written in a higher programming language to access a number of terminals through one stream by means of the standard input/output system included in the language. Besides TEM operates the devices in parallel with the application processing transactions, which will ensure a higher degree of service to the terminals and a better utilization of hardware, than if the accessing was performed by the application itself.

This manual contains the following information:

Chapter 2 describes the functions of TEM. The formats of the information exchanged between TEM and an application program are also specified.

Chapter 3 describes the start up procedures and how to operate TEM in the day to day running.

Chapter 4 is a guide in system generation. In this chapter the procedures concerning installation and trimming of TEM is described.

2. REFERENCE MANUAL 2.

2.1 Some TEM Concepts 2.1

2.1.1 Terminal Pools and Terminal Links 2.1.1

When an application program wants to access a set of devices via TEM, it asks TEM to define a terminal pool. For every device the application wants to use, a terminal link must be created between the pool and the external process corresponding to the device. Accessing of devices is performed by TEM on request from the application. The mode of operation is partly defined in the link creation phase and partly by explicit input/output commands to a pseudo process corresponding to the pool.

2.1.2 Names of Pools 2.1.2

The name of a pool must obey the naming rules defined in the monitor, ref. [3]. These rules state that a name is a textstring consisting of 12 ISO characters beginning with a small letter followed by at most 10 small letters or digits, terminated by NULL characters.

2.1.3 Types and Names of Terminal Links 2.1.3

When a link from a pool to a device is created, the corresponding external process must be specified. The process kind may be of any type, but in the present version of TEM only the following access protocols are supported:

1) TTY compatible processes.

   For this protocol TEM offers two access modes:

   a) link type = 0
      TTY multi-terminal.
      TEM offers spooling and multiplexing facilities.

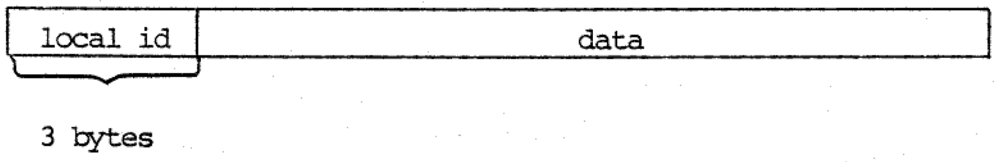
b) link type = 2
TTY single terminal.
Only spooling facilities.

2) Format 8000 termin and termout processes ref. [5]
link type = 4
Multiplexing and spooling is supported.

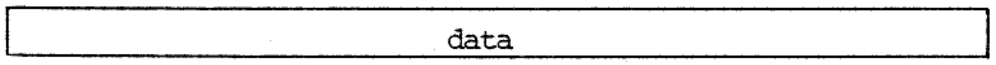
A link is identified by a name (local id), consisting of 24 bits (3 bytes). This name is defined by the application, and must be unambiguous within the pool.

2.1.4 Blocks and Transactions

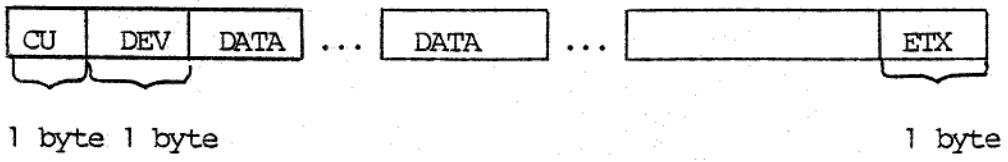
a) Type = 0 (TTY multi-terminal)
1 transaction = 1 block



b) Type = 2 (TTY single terminal)
1 transaction = 1 block



c) Type = 4 (termin and termout processes)
1 transaction = n blocks n >= 1



ref. [4]

2.1.5 Multiplexing

TEM is able to handle a number of external processes for a number of applications (internal processes). An external process may not be included in more than one pool at a time. When an application sends output to a pool, the link is addressed as part of the transaction. Depending on the linktype the address information is stripped off or altered before the transaction is sent to the device. Correspondingly address information is added to input before data is delivered to the application.

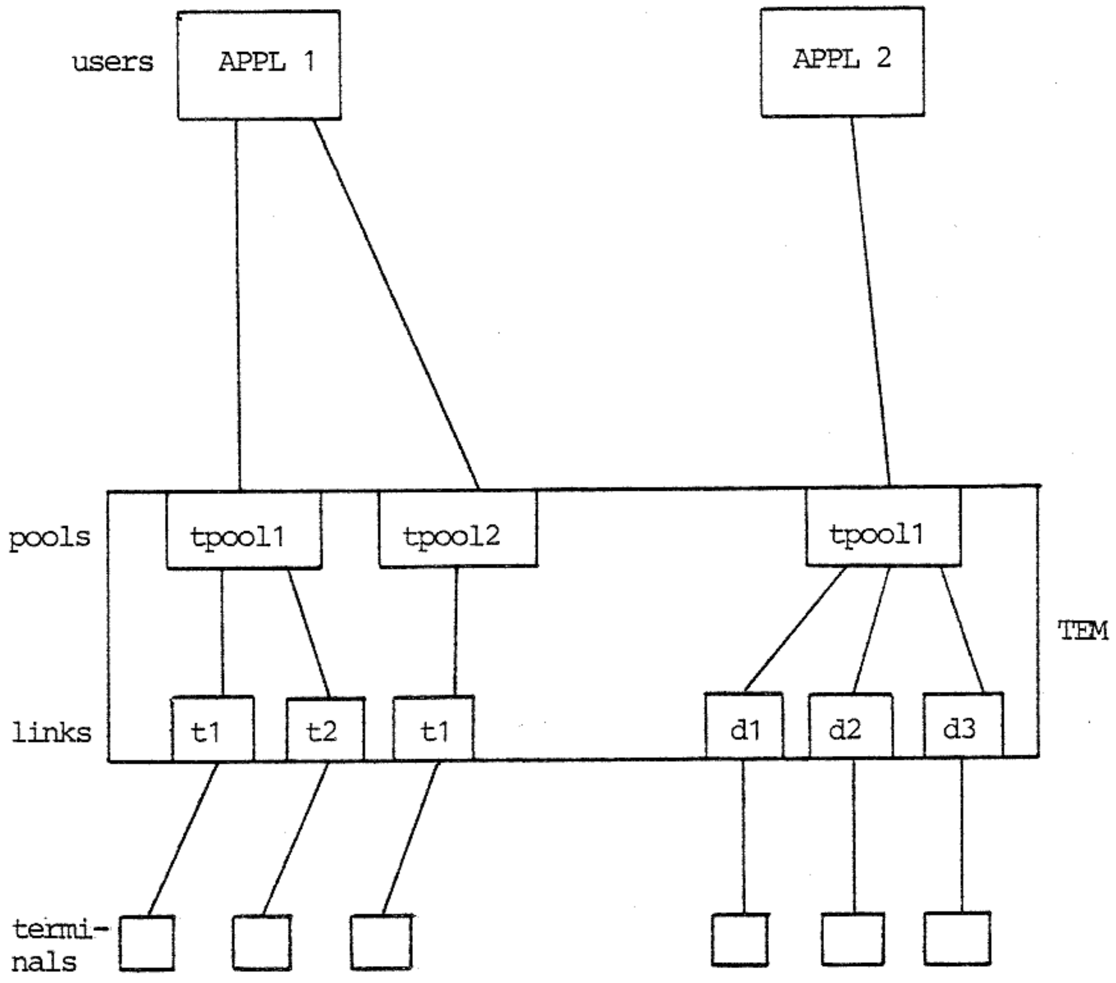


Figure 1: A TEM Configuration.

2.1.6 Spooling 2.1.6

In order to equalize differences in speed between the user process and the relative slow devices, TEM provides spooling of input and output. This spooling is done partly in primary store and partly on backing store. Every link and pool has its own spool queue with a maximal size which is defined when TEM is installed.

The queues contain operations not yet performed. The link (queue) accomodates input/output operations and output data, and the pool (queue) accomodates answers to input operations and input data.

2.2 TEM Operations 2.2

An application uses TEM by calling the operations listed in the next subsections. This is done by means of the send message/wait answer procedures of the monitor, ref. [1].

The operations are divided in the two groups:

1) Control operations.
2) Input/output operations.

The conventions for input and output operations follow the standards defined in the monitor, ref. [1], while the control operations are designed especially for TEM.

2.2.1 Control Operations 2.2.1

Operations concerning pools are activated by sending a message to TEM while link operations are sent to a pseudo process with the same name as the corresponding pool. This pool is made by TEM when the pool is created.

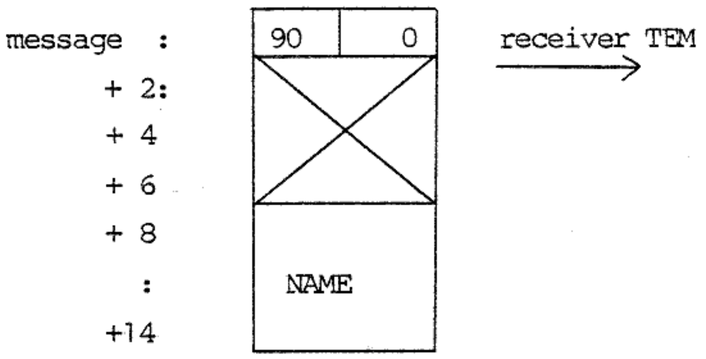
The first word of the answer from a control operation contains a status mask, indicating the result of the operation. The status word is only defined when the result of the answer is normal (W0 = 1). Dummy answers are delivered in the following situation:

Result = 3	unintelligible message

Interpretation of the status bits is defined below:

bit	meaning	
13	pool exists or pseudoprocess does not exist and cannot be created	1024
14	link exists	512
15	pool does not exist	256
16	link does not exist	128
17	no free pool	64
18	no free link	32
19	terminal in existing link	16
20	terminal not in existing link	8
21	terminal unknown	4
22	-	2
23	-	1

2.2.1.1 Create Pool

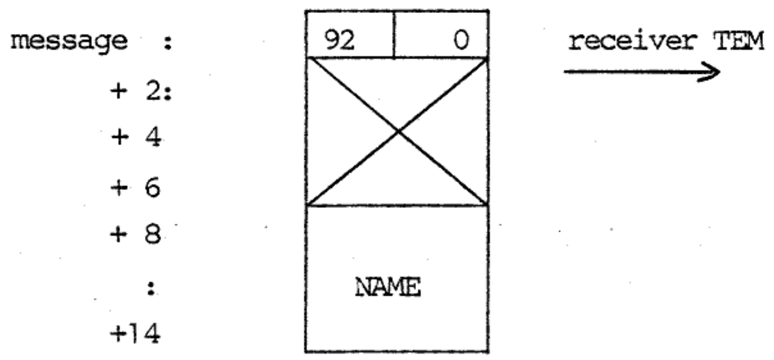


The operation creates a terminal pool with the sending process as exclusive user. A pseudoprocess with the name specified in message (8:15) is created. It is legal to define TEM as the pool. In this case no pseudoprocess is created, but TEM itself will act as receiver of messages concerning the pool.

N.B. In connection with the creation TEM sends a message with operation code (halfword 0) equal to -2. Answer on this message will cause the same actions as a call of the operation remove pool.

Possible status bits: 13, 17.

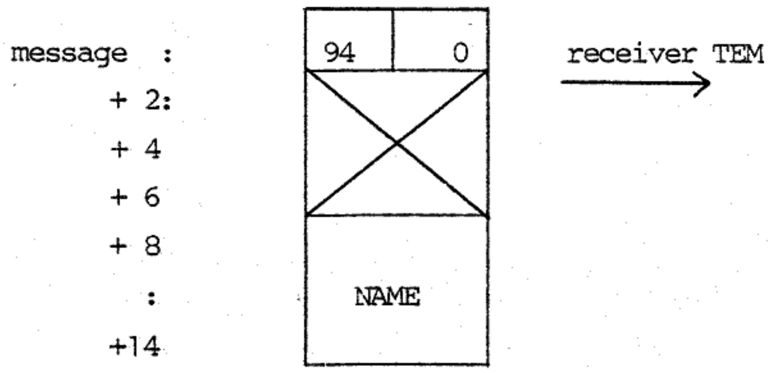
2.2.1.2 Remove Pool



The operation removes the terminal pool.

Possible status bits: 15.

2.2.1.3 Lookup Pool



If the sender is user of the pool the answer contains:

answer :	status
+ 2:	
+ 4	
+ 6	
+ 8	
+10	block full
+12	halfword free
+14	

'block full' is the number of input blocks spooled for the pool, i.e. the number of blocks read by TEM, but not delivered to the user yet. 'halfword free' is the number of halfwords left for further input spooling.

2.2.1.3

Possible status bits: 15.

2.2.1.4 Create Link

2.2.1.4

message :	100	type
+ 2:	local id.	
+ 4:	ext. proc. descr. adr.	
+ 6:	bufs	timer
+ 8:	mask	subst.

receiver terminal

$\longrightarrow$ pool

The operation includes a new terminal in a terminal pool. The local name of the link is stated in message (2:3). The terminal is identified by the process description address (message (4:5)).

'bufs' (message (6)) is the maximal number of spooled indata transactions. When the user asks for input, a number of input operations are initiated on all links with fewer input transactions spooled than defined by 'bufs'. If the link represents a 'termin' (format 8000) process the value is recommended to be: <no of terminals> * 8.

'timers' (message (7)) states the maximum number of timer periods, which may pass before the application is answered. I.e. the user may extend the timerperiod for the device n times relative to standard, by setting message (7) to n-1.

'mask' and 'subst' are used in connection with format 8000 links only. Explanation is given below.

Input and output operations are queued for the link and executed in order of arrival.

Depending on the link type input and output are handled as described in the following:

1) Type = 0 (TTY multiterminal)

a) Output.
A transaction matches the link if the first 3 bytes (24 bits) of the transaction equals the local identification of the link.

Before the transaction is sent to the device, the address information is stripped off.

b) Input.
The input transaction sent to the user is the local identification (3 bytes) concatenated with the block received from the device. If the data is not terminated with the ISO character NL (value = 10), 3 bytes are inserted at the end of the transaction: NL NUL NUL.

2) Type = 2 (TTY single terminal)

Input and output are spooled in TEM and routed between the user and the external process representing the device without modification of data.

3) Type = 4 (format 8000 termin and termout)

a) Output.

A transaction matches the link if:
(extend CU) and mask = subst and mask

Before the transaction is sent to the device the CU byte is changed:

CU:= CU and (-,mask)

b) Input.

The CU-byte is modified, before the transaction is sent to the user:

CU:= CU or (mask and subst) extract 8.

One should notice, that while the length of CU is 8 bits, mask and subst are 12 bits, and when searching for the link in connection with output operations, 12 bits are compared, as CU is extended with 4 bits equal to 0.

The purpose of this is the following:
If a pair of links (termin, termout) is connected to the same pool, the value of CU received by the application from the input link ought to be returned unchanged on the output link. I.e. that mask (4:11) and subst (4:11) for these links should be equal.

To ensure that the output operations are really sent on to the output link, one must in the call of the create link operation for the termin process put (mask (0:3 and subst (0:3)) <> 0 and for the termout process put (mask (0:3) and subst (0:3)) = 0.

For the termout link 'bufs' must be equal to 0, while typically the termin link should be multibuffered.

It is the responsibility of the user to ensure that the addressing of output is unambiguous. This should be noticed particularly if links of different types are connected to the same pool.

Possible status bits: 14, 15, 18, 19, 21.

2.2.1.5 Remove Link

message :	102	0/1	$\xrightarrow{\text{receiver}}$ terminal pool
+ 2:	localid		

The operation removes a terminal link from a pool. The removal may be performed soft or hard, i.e. activities in progress may be terminated or suspended before the removal. In the first case message (1) must equal 0, in the second 1. The answer on a soft removal is given when the operation is initiated and tells thus nothing about the termination of the last activity on the link.

Possible status bits: 15, 16.

2.2.1.6 Lookup Link

message :	104	0	$\xrightarrow{\text{receiver}}$ terminalpool
+ 2:	localid		

If the link is known the answer will be:

answer :	status = 0	
+ 2:	localid	
+ 4:	term.proc.descr.adr.	
+ 6:	bufs	timers
+ 8:	pool	
+10:	blocks full	
+12:	halfwords free	

Message (2:7) contains the same information as the corresponding fields in the create link message.

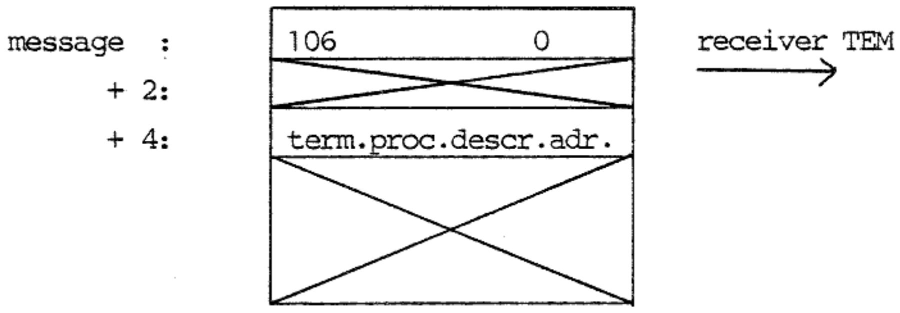
Message (8:9) is the process description address of the pseudo process corresponding to the pool.

Message (10:11) contains the number of operations in queue for the link. I.e. the number of input and output operations sent to the link, but not yet executed.

Message (12:13) tells whether the pool queue to the link is full or not. If the value is 0 further input/output operations will be delayed until some of the activities in progress to the device has been completed.

Possible status bits: 15, 16.

2.2.1.7 Lookup Terminal



Answer as for lookup link.

Possible status bits: 16, 19, 21.

If bit 19=1, the terminal is in a link, but the corresponding pool is created by another user.

2.2.2 Input/Output Operations

The input/output operations of TEM are similar to the operations known from the external processes in the monitor ref. [1], ref. [5], ref. [6].

The following functions have been implemented:

1) Sense.
2) Sense ready.
3) Format 8000 device control.
4) Input.
5) Output.

This means that an application may use the basic I/O-system of the file processor or the high level languages.

In addition a few operations to control the multiplexing and spooling in TEM is introduced:

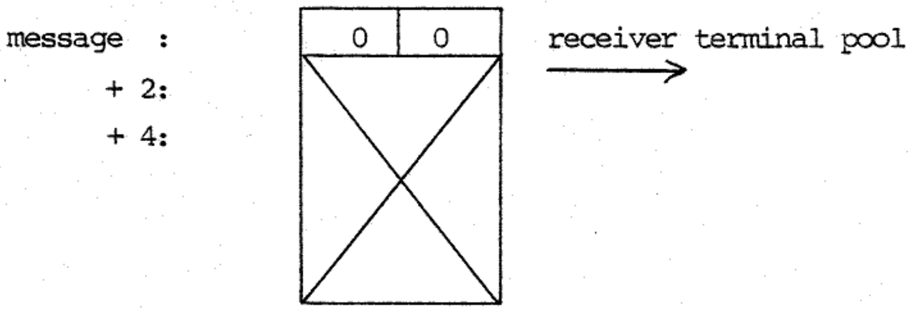
1) Simulate input.
2) Start input.

The formats for answers are as defined in ref. [1] for external processes.

TEM generates dummy results (W0 <> 1) in the following situations:

2: Application not user of the pool.
3: Message unintelligible.
4: Link not known in pool.

2.2.2.1 Sense 2.2.2.1



answer :	0
+ 2:	0
+ 4:	0
	☒

2.2.2.2 Sense Ready

message :	0	2	receiver terminal pool $\longrightarrow$
	☒		

answer :	status
+ 2:	0
+ 4:	0
	☒

First input operations are initiated as described in 2.2.1.4. Then an answer from an external process is waited for. If data is ready the sense ready operation is answered with status = 0. Else the operation is returned with the answer delivered by the external process.

2.2.2.3 Format 8000 Device Control

message :	2	operation	[illegible] $\longrightarrow$
+ 2:	modifier		
+ 4:	physical address		
+ 6:	logical address		
+ 8:	local-id *)		

answer :	status
+ 2:	result
+ 4:	physical address
+ 6:	logical address

*) The two byte device address used in communication with TEM, i.e. LOCAL-ID:

0	CU	DEVICE

The message is forwarded to the termout process indicated by local-id and the answer is returned unchanged by TEM, ref. [6].

The message must be sent on an outputlink.

2.2.2.4 Input 2.2.2.4

message :	3	mode	receiver terminal pool
+ 2:	first adr.		
+ 4:	last adr.		
. . .			
+14:			

answer :	status
+ 2:	halfwords
+ 4:	no. of chars.
+14:	

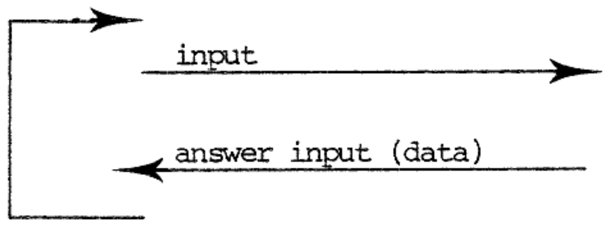
First input operations are initiated as described in 2.2.1.4. Secondly an answer from some external process in the pool is waited for. The answer including the indata delivered is returned to the user, perhaps modified with address information.

Because input may be initiated asynchronous with the input message from the user, some comments may be necessary.

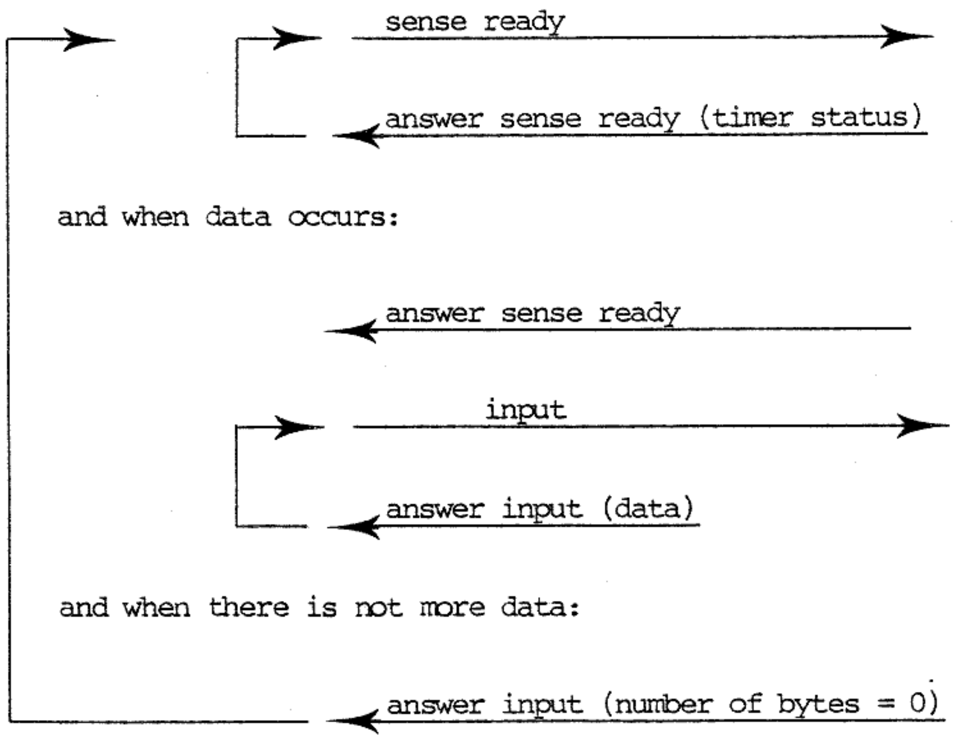
The mode field in the first input operation defines the input mode in the whole lifetime of the pool. Correspondingly, the indata buffer that the application makes available, may be too small for the block received from an external process. Normally TEM delivers data with the original blocking, but in this case indata is divided into smaller portions.

The first time the indata stream runs empty after a sense ready operation has been called, the input operation is answered immediately with zero answer. This means that the user may chose freely between two different input protocols, namely the traditional protocol and the sense ready protocol.

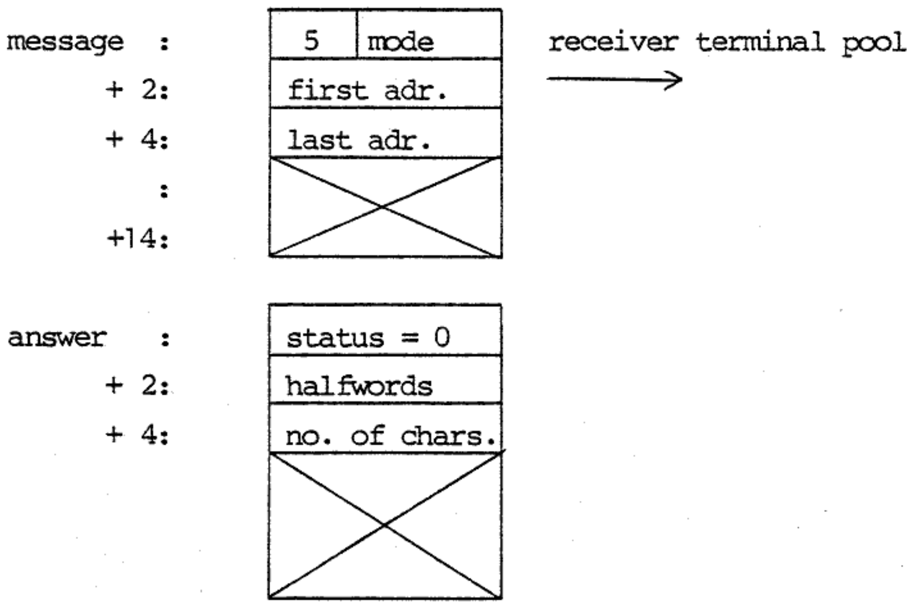
Traditional protocol:



Sense ready protocol:


sense ready
answer sense ready (timer status)
and when data occurs:
answer sense ready
input
answer input (data)
and when there is not more data:
answer input (number of bytes = 0)

2.2.2.5 Output



If the link exists, the result of the operation will be normal and status = 0. As the operation is taken over by TEM asynchronous with the working of the device, hard errors are not reported to the application.

In type 0 and type 2 links the mode field of the output operation is used to signal whether the next input operation should be in non- display mode (e.g. entering of password information):

```
   if mode shift (-3) extract 1 = 1 then
   begin
     mode := mode-8;
     non_display_mode := true;
   end
   else non_display mode := false;
```

The spooling facilities of TEM means that the pool will act as a (very) fast device. Only if the spool queue is full, the answer will be delayed by the working of the device.

The largest blocksize accepted by TEM is 450 halfwords. This number is independent of the trimming of TEM.

2.2.2.6 Simulate Input

message :	9	mode	receiver terminalpool $\longrightarrow$
+ 2:	first adr.		
+ 4:	last adr.		
:	☒		
+14:	☒		

answer :	status = 0
+ 2:	halfwords
+ 4:	no. of chars.

This operation is defined for links of type 0 only. The link addressed in the data area referenced by message (2:3) and message (4:5) is <u>removed</u> and created again. The data area specified will be handled by TEM in the same way as indata from the device. I.e. it will be delivered as data to the user process in a later input operation.

2.2.2.7 Start Input

message :	110	mode	receiver terminal pool $\longrightarrow$
+ 2:	local id		
+ 4:	☒		
+ 6:	bufs	☒	
:	☒		
+14:	☒		

answer :	status = 0
+ 2:	0
+ 4:	0
:	☒
+14:	☒

Independent of the normal input spooling 'bufs' input operations on the link are initiated.

The automatic activation of input operations as defined in the creation of the link is not resumed before the number of outstanding transactions becomes less than standard.

3. OPERATING GUIDE 3.

The operator's tasks in the day to day running of TEM comprise the following:

1. The start up.
2. Closing down.
3. How to handle error situations.

In the following the operating system 's' is implied. If another operating system is used, commands and messages may be different.

3.1 The Start-Up 3.1

During start-up the system calculates the optimal set of resources. If TEM is started with more or less resources than necessary, the optimal value is displayed as a parent message. If resources are missing the message is marked with '***' and the run is terminated at once.

The name of the program to be loaded is 'btem'. Formulas for computing the resource claims are given in subsection 4.4.2.

Example 1:
Output from the computer in this and the following examples are written with capital letters, while input from the operator is indicated by small letter.

```
ATT s
new tem size 10000 buf 30 area 4
READY
ATT s
prog btem base -8388607 8388605 run
READY
MESSAGE TEM VERSION: 830401 0
MESSAGE TEM SIZE      9320
MESSAGE TEM *** AREA     6
MESSAGE TEM BUF         20
PAUSE TEM *** INIT TROUBLES
```

```
ATT s
remove area 6 buf 20 run
READY
MESSAGE TEM VERSION: 830401 0
MESSAGE TEM SIZE     9320
MESSAGE TEM STARTED
```

TEM is started with too few area processes. Therefore the run is terminated. The optimal values of coresize, area processes and message buffers are displayed. Then the TEM process is removed and started again with a reasonably set of resources, but the coresize is still larger than necessary.

Syntax of a start up message:

$$\left\{\begin{matrix}\text{message}\\ \text{pause}\end{matrix}\right\}\ \text{tem}\ \left\{\begin{matrix}\text{***}\\ \text{<sp> <sp> <sp>}\end{matrix}\right\}\ \text{<message text>}$$

List of start up message texts	
version:<i> <i>	the date of the TEM release and the date of options are displayed.
size <i>	optimal value of coresize.
area <i>	optimal value of area processes.
buf <i>	optimal value of message buffers.
<name of area> <i>	too few resources for creating work areas.
started	tem is running.
init troubles	resources missing, execution terminated.

3.2 Closing the System 3.2

There exists no close command in TEM. Closing down after a normal run is done by simply removing the process as seen below:

```
ATT s
proc tem remove
READY
```

3.3 How to Handle Error Situations 3.3

During the run the system may break down in one of the following ways:

1. A program error may cause the system to break down, and the following error message will be printed on the terminal from where the system was started:

   ```
   PAUSE TEM    *** FAULT
   ```

2. The system dies without printing a message. Then the process ought to be 'breaked' in order to have the last portion of testoutput generated, written on the testarea:

   ```
   ATT s
   proc tem break
   READY
   ```

3. A hard error in a work area makes continued running impossible and the system stops after printing the message:
   PAUSE TEM STATUS <status word>   <area>

In all error situations one should, if the system has been trimmed with 'testoutput' move this from the test area TEMTEST to a work area, from which the TRACE-program can print it for further analyses.

The TRACE program is automatically generated by the installation of the system. The program is called as follows:

```
trace  <testarea> . <segments>
```

<testarea> is the name of the area, from which the testoutput is to be printed (the work area the testoutput has been moved to, or the test area itself).

<segments> are the maximum number of segments to be analyzed. TRACE always finds the latest generated segments, and counts the number of segments backwards from there. <segments> are automatically cut to the size of the area, if something larger has been specified.

Example 2:
An s-run; testoutput is printed before a restart.

```
ATT s
proc tem remove new tem run
READY
o lp
trace temtest.10000 (everything is printed)
o c
ATT s
proc tem remove
   -      (a new start-up)
```

Example 3:
A BOSS-run; the testoutput has been moved to the area TESTCOPY.

```
10 o pip
20 trace testcopy.10000 (everything is printed)
30 o c
40 convert pip
50 finis
go
```

4. SYSTEM GENERATION

4.1 Installation

TEM may be installed on the RC4000 and the RC8000 series computers. Before installation check that the version of

a) your monitor is $\geq$ 5.0
b) your algolcompiler is ALGOL7 or newer.

In order to ensure a high degree of flexibility and a good utilization of hardware, the system staff may adapt the system.

Before the system is trimmed one has to consider the following quantities:

"options"	At start up a constant showing the date of the TEM system will be listed together with this constant. At each trimming the constant should be changed to show the date of the trimming (e.g. 830415). The standard value is 0 indicating that standard options are used.
"thcount"	The maximal number of terminals and format 8000 links running under TEM at the same time.
"phcount"	The maximal number of terminal pools.
"phspoolsegm"	Number of spoolsegments per terminal pool. I.e. the maximal size of the queue used to spool input to the pool (used by answers to input operations and input data).
"thspoolsegm"	Number of spoolsegment per terminal link. I.e. the maximal size of the queue used to spool operations to a terminal (used by input/output operations and output data).

"thbufsize"	Number of spoolbuffers in core (segment buffers). If this trim parameter is made larger, the number of transports to and from backing storage in connection with spooling of data between the applications and the terminals will decrease. The expense will be 512 halfwords in primary store pr. buffer.
"testsegments"	The number of testoutput segments. If this number is zero no testoutput is generated. Performance is higher if testoutput is suspended, but the possibilities for discovering system errors will be minimal. If TEM is running together with systems also producing testoutput (e.g. SOS) the need for testoutput will be less and the generation of testoutput may be stopped.

Please observe that:

a) input/output operations and output data are accomodated in 'thspoolsegn',

b) answers to input, sense and sense ready operations and input data are accomodated in 'phspoosegm'.

In installation servicing format 8000 terminals one should consider that:

a) the time any CU will wait to deliver an input block is approx. 15 seconds,

b) a screen image may consist of more blocks (1 block = approx. 258 bytes, 1 image = 2000 bytes or more),

c) input blocks from the CU may be delayed if the IBM 3270 terminal handler is short of free input buffers,

d) input buffers in the IBM 3270 terminal handler are released when honouring input operations from e.g. TEM.

As a consequence it is recommended to:

a) accomodate enough space in the spool queue to honour input requests from all terminals serviced by a pool at any time (phspoolsegm = 3*(no of terminals); approx.),

b) prepare the application to utilize the spooling capacities of TEM by assigning an appropriate value to the parameter 'bufs' in the call of the 'create link' message to TEM (bufs = (no of terminals serviced by this link)*8 approx).

The system trimming is done by means of the file temtrim (see appendix C), which contains a set of standard variables plus comments for generating the trimmed version of the program.

Installation may be done after the files have been 'loaded to disc' or direct from tape.

a) Installation from tape.

If the system tape is called mtsw8100, the installation is performed as shown below:

```
temdoc   =     set 1 <discname> ; default = disc
mipshelp =     set mto mtsw8100 0 2
i          mipshelp
i          temhelp
xtrim = edit temtrim

           EDIT COMMANDS
i xtrim
```

b) Installation from diskette.

If the system diskettes are called S18100 and S28100 the installation is performed as shown below:

```
"fdload S18100.1"
```

fdload itself will ask for mounting of the continuation volume.

When the files have been loaded, use the fp command:

```
'i mipshelp'
```

You may now proceed with paragraph c), installation from backing storage.

c) Installation from backing storage.

```
temdoc   =     set 1 <discname> ; default = disc
i      temhelp
xtrim = edit temtrim

         EDIT COMMANDS
i xtrim
```

Example 4:

The installation is done from the tape mtsw8100, and the trim parameters 'thcount' and 'testsegments' are changed to 10 and 0 respectively.

```
temdoc   = set 1 disc 2
mipshelp = set mto mtsw8100 0 2
i      mipshelp
i      temhelp

xtrim = edit temtrim

1./thcount/, r/15/10/,               (10 active terminals)
1./testsegments/, r/42/0/,           (suspend testoutput)
f
i      xtrim
```

4.2 Resource Demands 4.2

4.2.1 When Installing 4.2.1

The process used for installation may run with standard resources except that:

a) Coresize must be >= 50000 halfwords, 60000 reasonable.

b) User scope must equal system scope (-8388607: 8388605). If this is not the case, the scope of the files btem and trace must be changed by hand to system scope after the installation.

c) At the first installation, permanent backing storage resources must be available for the above mentioned files.

4.2.2 When Running 4.2.2

In the go through below the resource demands of TEM when running are listed. As it may be seen from the formulas the demands vary much depending on the TEM trimming.

Primary store (halfwords):	
Standard consumption approx:	6800
Terminal pool descriptions:	phcount * 74
Terminal link descriptions	thcount (108 + termbufsize)
Spoolbuffer	spoolbus * 516
Test buffer (optional)	1024

Message buffers:	
Constant consumption	2
pool consumption	phcount x 2
Link consumption	thcount

Area processes:	
Constant consumption	2
Pool consumption	phcount

Backing storage segments:

Testarea	testsegments
Spool area	phcount * (phspool segm +1) + thcount * (thspool segm +1)

Example 5:

If the trim parameters of TEM are set 10

```
options:=          830401,
thcount:=              10,
phcount:=               4,
termbufsize:=         104,
phspoolsegm:=           8,
thspoolsegm:=           8,
spoolbus:=              2,
testsegments:=         42,
```

the resource demands will be

```
Primary store:              10212
Message buffers:               20
Area processes:                 6
Backing storage segments:     168
```

A. REFERENCES

[1] RCSL No 31-D476:
Monitor Part 1, System Design

[2] RCSL No 31-D300:
Monitor 3

[3] RCSL No 31-D477:
RC8000 Monitor, Part 2, Reference Manual

[4] RCSL No 52-AA640:
Format 8000 - A transaction Oriented System General Description. Revision a

[5] RCSL No 31-D693:
IBM 3270 Terminal Handler
User's Guide

ref :

B. PROGRAM EXAMPLES B.

The examples in this appendix illustrate how the facilities of TEM are used by an application program written in ALGOL.

Example 6: is a set of procedures, which makes it simple to call the control operations of TEM.

Example 7: is a program communicating with a number of terminals. The terminals are defined at start up. A transaction is read from a terminal. The indata is processed and an answer is printed. As the example should illustrate the use of TEM only, the processing of a transaction is very simple: The number of lines received from the terminal is counted, and the input line will be echoed on the terminal.

Example 8: is also a multiterminal program. But in this case the terminals are logged in and logged out dynamically. A terminal is logged in when the attention button on the keyboard is pressed, and logged out, after an '*' has been written on the terminal. The example illustrates the use of the sense ready operation. The program handles transactions as in example 7. But when the indata stream runs empty the reading is interrupted by the block procedure. Processing is continued in the main loop of the program. This loop treats events from the monitor. In this simple example only two kinds of events are of interest: attention messages (log in) and answer on a sense ready operation.

Example 9: is a utility program, which creates terminal pools and terminal links. Such a program may be of interest, e.g. when an application, where the program has communicated with the external processes itself, is re-layed to use TEM to interface the devices. The utility program is called so that the pools and the links exist when the application program is started.

Example 6:

Example 7:

Example 8:

(to be continued)

(continued)

Example 9:

C. TEMTRIM C.

Example 10:

RETURN LETTER

Title:	Terminal Access Module (TEM) User's Guide/Reference Manual/ Installation Guide	RCSL No.:	31-D689

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Example 6:

```
INTEGER PROCEDURE CREATEPOOL(Z);
ZONE Z;
BEGIN
  INTEGER I;
  INTEGER ARRAY ZIA(1:20),SIA(1:12);
  ZONE ZTEM(1,1,STDERROR);
  OPEN(ZTEM,0,<:TEM:>,0);
  GETZONE6(Z,ZIA);
  GETSHARE6(ZTEM,SIA,1);
  SIA(4):=90 SHIFT 12;
  FOR I:=0 STEP 1 UNTIL 3 DO SIA(8+I):=ZIA(2+I);
  SETSHARE6(ZTEM,SIA,1);
  MONITOR(16,ZTEM,1,SIA);
  CREATEPOOL:=IF MONITOR(18,ZTEM,1,SIA) <> 1 THEN -1 ELSE SIA(1);
  CLOSE(ZTEM,TRUE);
END CREATEPOOL;


INTEGER PROCEDURE REMOVEPOOL(Z);
ZONE Z;
BEGIN
  INTEGER I;
  INTEGER ARRAY ZIA(1:20),SIA(1:12);
  ZONE ZTEM(1,1,STDERROR);
  OPEN(ZTEM,0,<:TEM:>,0);
  GETZONE6(Z,ZIA);
  GETSHARE6(ZTEM,SIA,1);
  SIA(4):=92 SHIFT 12;
  FOR I:=0 STEP 1 UNTIL 3 DO SIA(8+I):=ZIA(2+I);
  SETSHARE6(ZTEM,SIA,1);
  MONITOR(16,ZTEM,1,SIA);
  REMOVEPOOL:=IF MONITOR(18,ZTEM,1,SIA) <> 1 THEN -1 ELSE SIA(1);
  CLOSE(ZTEM,TRUE);
END REMOVEPOOL;


INTEGER PROCEDURE CREATELINK(Z,TYPE,ID,PROCREF,BUFS,TIMERS,
                             MASK,SUBST);
ZONE Z;
INTEGER TYPE,ID,PROCREF,BUFS,TIMERS,MASK,SUBST;
BEGIN
  INTEGER I;
  INTEGER ARRAY ZIA(1:20),SIA(1:12);
  LONG ARRAY ARR(1:2);
  ZONE ZTEM(1,1,STDERROR);
  GETZONE6(Z,ZIA);
  ARR(1):=ZIA(2); ARR(1):=ARR(1) SHIFT 24 ADD ZIA(3);
  ARR(2):=ZIA(4); ARR(2):=ARR(2) SHIFT 24 ADD ZIA(5);
  I:=1;
  OPEN(ZTEM,0,STRING ARR(INCREASE(I)),0);
  GETSHARE6(ZTEM,SIA,1);
  SIA(4):=100 SHIFT 12 ADD TYPE;
  SIA(5):=ID;
  SIA(6):=PROCREF;
  SIA(7):=BUFS SHIFT 12 ADD TIMERS;
  SIA(8):= MASK SHIFT 12 ADD SUBST;
  SETSHARE6(ZTEM,SIA,1);
  MONITOR(16,ZTEM,1,SIA);
  CREATELINK:=IF MONITOR(18,ZTEM,1,SIA) <> 1 THEN -1 ELSE SIA(1);
  CLOSE(ZTEM,TRUE);
END CREATELINK;


INTEGER PROCEDURE REMOVELINK(Z,ID,IMMEDIATE);
ZONE Z;
INTEGER ID;
BOOLEAN IMMEDIATE;
BEGIN
  INTEGER I;
  INTEGER ARRAY ZIA(1:20),SIA(1:12);
  LONG ARRAY ARR(1:2);
  ZONE ZTEM(1,1,STDERROR);
  GETZONE6(Z,ZIA);
  ARR(1):=ZIA(2); ARR(1):=ARR(1) SHIFT 24 ADD ZIA(3);
  ARR(2):=ZIA(4); ARR(2):=ARR(2) SHIFT 24 ADD ZIA(5);
  I:=1;
  OPEN(ZTEM,0,STRING ARR(INCREASE(I)),0);
  GETSHARE6(ZTEM,SIA,1);
  SIA(4):=102 SHIFT 12 +(IF IMMEDIATE THEN 1 ELSE 0);
  SIA(5):=ID;
  SETSHARE6(ZTEM,SIA,1);
  MONITOR(16,ZTEM,1,SIA);
  REMOVELINK:=IF MONITOR(18,ZTEM,1,SIA) <> 1 THEN -1 ELSE SIA(1);
END REMOVELINK;


INTEGER PROCEDURE TERMINALID(TERMINALNUMBER);
INTEGER TERMINALNUMBER;
TERMINALID:=((TERMINALNUMBER//10 + 48) SHIFT 8 ADD
            (TERMINALNUMBER MOD 10) + 48) SHIFT 8 ADD 32;
```

Example 7:

```
;              ***  TTEMTEST  ***
;
;
; A TESTPROGRAM FOR SIMPEL TESTING OF THE TEM SYSTEM
;
; PROGRAM CALL:
;     TEMTEST TERM,<TERMINALNAME-1>,<TERMINALNAME-2>, ...  <TERMINALNAME-N>
;
; THE PROGRAM ACTS LIKE THIS:
;
;     CREATE TERMINAL POOL
;     CREATE LINKS TO ALL TERMINALS SPECIFIED IN PROGRAM CALL
; LOOP
;     READ AN INPUT LINE FROM A CONNECTED TERMINAL
;        (THIS INPUT LINE STARTS WITH A TERMINAL NUMBER)
;     INCREASE LINECOUNT(TERMINAL NUMBER)
;     WRITE TERMINAL IDENTIFICATION
;     WRITE TERMINAL NUMBER
;     WRITE LINE COUNT
;     WRITE CONTENT OF INPUT LINE
;     GOTO LOOP


BEGIN
  ZONE Z(26,1,STDERROR);
  INTEGER I,ACTIVETERMINALS,MAXTERMINALS,CURRTERMINAL,RESULT,TERMINALREF;
  REAL ARRAY ARR(1:2);

  ALGOL COPY.1; <* COPY TEM PROCEDURES *>


  <*   CREATE TERMINAL POOL    *>

  OPEN(Z,8,<:TEM:>,0);
  CREATEPOOL(Z);
  MAXTERMINALS:=ACTIVETERMINALS:=0;


  <*   CONNECT ALL TERMINALS SPECIFIED IN PROGRAM CALL   *>

  BEGIN
    INTEGER J;
    INTEGER ARRAY IA(1:10);
    ZONE DUMMY(1,1,STDERROR);
    I:=2;
    FOR I:=I WHILE SYSTEM(4,I,ARR) = 8 SHIFT 12 + 10 DO
    BEGIN
      MAXTERMINALS:=MAXTERMINALS+1;
      J:=1;
      OPEN(DUMMY,0,STRING ARR(INCREASE(J)),0);
      TERMINALREF:=MONITOR(4,DUMMY,0,IA);
      RESULT:=CREATELINK(Z,
                 0,TERMINALID(MAXTERMINALS),TERMINALREF,1,0,0,0);
      IF RESULT <> 0 THEN
        WRITE(OUT,<:<10>CREATELINK(:>,<<D>,TERMINALREF,<:) = :>,RESULT) ELSE
        ACTIVETERMINALS:=ACTIVETERMINALS+1;
      I:=I+1;
      CLOSE(DUMMY,TRUE);
    END;
  END;
  IF ACTIVETERMINALS < 1 THEN GOTO STOP;

  BEGIN
    INTEGER I,J;
    INTEGER ARRAY LINEBUF(1:100),LINECOUNT(1:MAXTERMINALS);
    FOR I:=1 STEP 1 UNTIL MAXTERMINALS DO LINECOUNT(I):=0;

  <*   READ A LINE AND DISPLAY IT ON CORRESPONDING TERMINAL   *>

LOOP:
    READ(Z,CURRTERMINAL);
    I:=1;
    FOR I:=I WHILE READCHAR(Z,LINEBUF(I)) <> 8 DO I:=I+1;
    SETPOSITION(Z,0,0);
    LINECOUNT(CURRTERMINAL):=LINECOUNT(CURRTERMINAL)+1;
    WRITE(Z,<<ZD>,CURRTERMINAL,<: TERM = :>,<<ZD>,CURRTERMINAL,
                  <: LINE = :>,<<DDD>,LINECOUNT(CURRTERMINAL),<:: :>);
    FOR J:=1 STEP 1 UNTIL I DO OUTCHAR(Z,LINEBUF(J));
    IF LINEBUF(1) = 42 THEN
    BEGIN   <*   A  STAR  IN FIRST POSITION MEANS LOGOUT   *>
      WRITE(Z,<:TERMINAL LOGGED OUT<10>:>);
      SETPOSITION(Z,0,0);
      REMOVELINK(Z,TERMINALID(CURRTERMINAL),FALSE);
      ACTIVETERMINALS:=ACTIVETERMINALS-1;
    END;

    SETPOSITION(Z,0,0);
    IF ACTIVETERMINALS > 0 THEN GOTO LOOP;
  END;

STOP:
  REMOVEPOOL(Z);

END
```

Example 8:

```
;              ***  TEM SENSE READY TEST  ***
;
;
; A TESTPROGRAM FOR SIMPEL TESTING OF THE TEM SYSTEM
;
; PROGRAM CALL:
;     <PROGRAMNAME>
;
; THE PROGRAM ACTS LIKE THIS:
;
;     CREATE TERMINAL POOL
; LOOP
      WAIT ATTENTION OR INPUT READY
      IF ATT THEN LOGIN GOTO LOOP
      READ LINE FROM TERMINAL
      WRITE TERMINAL NUMBER AND LINE NUMBER
      ECHO INDATA
      IF FIRST CHAR = * THEN LOGOUT
      GOTO LOOP


BEGIN
  INTEGER MAXTERMINALS;

  ALGOL COPY.1; <* COPY TEM PROCEDURES *>



  MAXTERMINALS:= 10;

  BEGIN
    BOOLEAN ARRAY PASSIVETERM(1:MAXTERMINALS);
    INTEGER ARRAY LINEBUF(1:100),LINECOUNT(1:MAXTERMINALS);
    ZONE ZIN(26,1,ENDOFDATA),ZOUT(26,1,STDERROR),
         SENSEREADY, ZHELP(1,1,STDERROR);
    INTEGER I,J,ACTIVETERMINALS,CURRTERMINAL,RESULT,
            TERMINALREF,BUFFERBASE;
    BOOLEAN POOLSENSED;
    INTEGER ARRAY IA(1:20);



    PROCEDURE ENDOFDATA(Z,S,B);
    ZONE Z;
    INTEGER S, B;
    BEGIN
      IF B=0 AND S=2 THEN
      GOTO CENTRALWAIT;
    END;

   <* CREATE TERMINAL POOL *>


    OPEN(ZIN,8,<:TEM:>,2);
    OPEN(ZOUT,8,<:TEM:>,0);
    CREATEPOOL(ZOUT);
    OPEN(ZHELP,0,<::>,0);
    OPEN(SENSEREADY,0,<:TEM:>,0);
    GETSHARE6(SENSEREADY,IA,1);
    IA(4):= 0 SHIFT 12 + 2; <* PREPARE SENSE READY OPERATION *>
    SETSHARE6(SENSEREADY,IA,1);
    ACTIVETERMINALS:= 0;
    BUFFERBASE:= 0;
    POOLSENSED:= FALSE;
    FOR I:= 1 STEP 1 UNTIL MAXTERMINALS DO PASSIVETERM(I):= TRUE;
```

(to be continued)

(continued)

```
CENTRALWAIT:
    IF ACTIVETERMINALS>0 AND -,POOLSENSED THEN
    BEGIN
      MONITOR(16) SENDMESSAGE:(SENSEREADY,1,IA);
      POOLSENSED:= TRUE;
    END;
    I:= BUFFERBASE;

    RESULT:= MONITOR(24)WAITEVENT:(ZHELP,I,IA);

    IF RESULT=0 THEN
    BEGIN <* (ATTENTION) MESSAGE ARRIVED *>
      IF IA(1)<>0 THEN
      BEGIN
        BUFFERBASE:= I;
        GOTO CENTRALWAIT;
      END;
      MONITOR(26)GET EVENT:(ZHELP,I,IA);
      IA(9):= 1;
      MONITOR(22) SEND ANSWER:(ZHELP,I,IA);
      TERMINALREF:= MONITOR(4) GET DESCRIPTION:(ZHELP,0,IA);
      FOR I:= MAXTERMINALS STEP -1 UNTIL 1 DO
      IF PASSIVETERM(I) THEN CURRTERMINAL:= I; <* FIND FREE TERMINAL NO *>
      RESULT:=CREATELINK(ZOUT,0,TERMINALID(CURRTERMINAL),TERMINALREF,
                         1,2047,0,0);
      IF RESULT<>0 THEN
      BEGIN
        WRITE(OUT,<:<10>CREATELINK(:>,<<DD>,TERMINALREF,<:) = :>,
              RESULT,<:<10>:>);
        SETPOSITION(OUT,0,0);
      END
      ELSE
      BEGIN
        WRITE(ZOUT,<<ZD>,CURRTERMINAL,FALSE ADD 32,1,
                <:TERMINAL LOGGED IN<10>:>);
        SETPOSITION(ZOUT,0,0);
        ACTIVETERMINALS:= ACTIVETERMINALS+1;
        PASSIVETERM(CURRTERMINAL):= FALSE;
        LINECOUNT(CURRTERMINAL):= 0;
      END;
      GOTO CENTRALWAIT;
    END
    ELSE
    BEGIN <* ANSWER ( SENSE READY ) *>
      MONITOR(18)WAIT ANSWER:(SENSEREADY,1,IA);
      POOLSENSED:= FALSE;

      REPEAT
        READ(ZIN,CURRTERMINAL); <* END OF DATA HANDLED BY BLOCKPROCEDURE *>
        I:= 1;
        FOR I:= I WHILE READCHAR(ZIN,LINEBUF(I)) <>8 DO I:= I+1;
        SETPOSITION(ZIN,0,0);
        LINECOUNT(CURRTERMINAL):= LINECOUNT(CURRTERMINAL)+1;
        WRITE(ZOUT,<<ZD>,CURRTERMINAL,FALSE ADD 32,1,
                <: TERM = :>,CURRTERMINAL,
                <: LINE = :>,<<DDD>,LINECOUNT(CURRTERMINAL),<:: :>);
        FOR J:= 1 STEP 1 UNTIL I DO OUTCHAR(ZOUT,LINEBUF(J));
        IF LINEBUF(1) = 42 THEN
        BEGIN <* A STAR IN FIRST POSITION MEANS LOGOUT *>
          WRITE(ZOUT,<:TERMINAL LOGGED OUT<10>:>);
          SETPOSITION(ZOUT,0,0);
          REMOVELINK(ZOUT,TERMINALID(CURRTERMINAL),FALSE);
          ACTIVETERMINALS:= ACTIVETERMINALS-1;
          PASSIVETERM(CURRTERMINAL):= TRUE;
        END
        ELSE SETPOSITION(ZOUT,0,0);
      UNTIL ACTIVETERMINALS=0;
    END
    REMOVEPOOL(ZOUT);
    CLOSE(ZIN,TRUE); CLOSE(ZOUT,TRUE);
  END;
END
```

Example 9:

```
      *********** TEM TEST CREATE POOL AND CREATE LINK *************


      PROGRAM CALL:
        <PROGRAMNAME> <POOLNAME>(.<TYPE>.<LOCID>.<PROCESS NAME>.<BUFS>.
                                  <TIMERS>.<MASK>,<SUBST>) 0->N


        <POOLNAME>,<LOCID>,<PROCESS NAME>::= <TEXT>
        <TYPE>,<BUFS>,<TIMERS>,<MASK>,<SUBST>::= <INTEGER>


      THE PROGRAM CREATES A TERMINAL WITH THE NAME <POOLNAME>. FOR EVERY
      SET OF LINK PARAMETERS A TERMINAL LINK IS CREATED

BEGIN
  ALGOL COPY.1; <* COPY TEM CONTROL PROCEDURES *>

  INTEGER I, J, RESULT,
          TYPE, LOCID, TERMINALREF, BUFS,TIMERS, MASK, SUBST;
  INTEGER ARRAY IA(1:20);
  REAL    ARRAY ARR(1:2);
  ZONE Z, DUMMY(1,1,STDERROR);

  IF SYSTEM(4,1,ARR)<>4 SHIFT 12+10 THEN SYSTEM(9,1,<:PARAM:>);
  I:= 1;
  OPEN(Z,8,STRING(ARR(INCREASE(I))),0);
  RESULT:= CREATEPOOL(Z);
  IF RESULT<>0 THEN SYSTEM(9,RESULT,<:CRPOOL:>);

  OPEN(DUMMY,0,<::>,0);
  I:= 0;
  REPEAT <* GET DUMMY MESSAGE FROM TEM *>
    RESULT:= MONITOR(24) WAIT EVENT:(DUMMY,I,IA);
    IF RESULT=0 THEN
    BEGIN
      IF IA(1) = -2 SHIFT 12 THEN
      BEGIN
        MONITOR(26) GET EVENT:(DUMMY,I,IA);
        I:= 0;
      END;
    END;
  UNTIL I=0;
  CLOSE(DUMMY,TRUE);

  I:= 1;
  FOR I:= I+1 WHILE SYSTEM(4,I,ARR)=8 SHIFT 12+4 DO
  BEGIN
    TYPE:= ARR(1);
    I:= I+1;
    IF SYSTEM(4,I,ARR)<>8 SHIFT 12+10 THEN SYSTEM(9,I,<:PARAM:>);
    LOCID:= ARR(1) SHIFT (-24) EXTRACT 24;
    I:= I+1;
    IF SYSTEM(4,I,ARR)<>8 SHIFT 12 +10 THEN SYSTEM(9,I,<:PARAM:>);
    J:= 1;
    OPEN(DUMMY,0,STRING(ARR(INCREASE(J))),0);
    TERMINALREF:= MONITOR(4,DUMMY,0,IA);
    CLOSE(DUMMY,TRUE);
    I:= I+1;
    IF SYSTEM(4,I,ARR)<>8 SHIFT 12+4 THEN SYSTEM(9,I,<:PARAM:>);
    BUFS:= ARR(1);
    I:= I+1;
    IF SYSTEM(4,I,ARR)<> 8 SHIFT 12+4 THEN SYSTEM(9,I,<:PARAM:>);
    TIMERS:= ARR(1);
    I:= I+1;
    IF SYSTEM(4,I,ARR)<> 8 SHIFT 12+4 THEN SYSTEM(9,I,<:PARAM:>);
    MASK:= ARR(1);
    I:= I+1;
    IF SYSTEM(4,I,ARR)<>8 SHIFT 12+4 THEN SYSTEM(9,I,<:PARAM:>);
    SUBST:= ARR(1);

    RESULT:= CREATELINK(Z,TYPE,LOCID,TERMINALREF,BUFS,TIMERS,MASK,SUBST);
    IF RESULT<>0 THEN SYSTEM(9,RESULT,<:CRLINK:>);
  END;

  IF SYSTEM(4,I,ARR)<>0 THEN SYSTEM(4,I,<:PARAM:>);
  CLOSE(Z,TRUE);
END

',F
```

Example 10:

```
;              ***  TEMTRIM  ***
;
;
; CONTAINS OPTIONS FOR TRIMMING TEM SYSTEM
; AND COMMANDS FOR AUTOMATIC SYSTEM GENERATION FROM THE TEM SYSTEM TAPE

MESSAGE TEM RELEASE 2.0


TEMDUMMYOUT=SET 1

XTEM = EDIT TTEM              ; EDIT OPTIONS INTO THE PROGRAM TEXT
L./BODY OF INIT/,
L./===TRIMSTART/,
D./===TRIMFINIS/,
I/


! DATE OF OPTIONS                                     ! OPTIONS     :=   0,
! NUMBER OF ACTIVE TERMINALS                          ! THCOUNT     :=  15,
! NUMBER OF ACTIVE TERMINAL GROUPS                    ! PHCOUNT     :=   5,
! NUMBER OF SPOOL SEGMENTS FOR EACH TERMINAL GROUP ! PHSPOOLSEGM :=  10,
! NUMBER OF SPOOL SEGMENTS FOR EACH TERMINAL          ! THSPOOLSEGM :=  10,
! SIZE OF TERMINAL BUFFER IN CORE (HALF WORDS)        ! TERMBUFSIZE := 104,
! NUMBER OF SPOOL SEGMENT BUFFERS IN CORE             ! SPOOLBUFS   :=   2,
! SIZE OF TESTOUTPUT AREA (SEGMENTS)                  ! TESTSEGMNTS :=  42,

/,
F

O TEMDUMMYOUT
MODE 1.NO
LOOKUP TEMDOC                 ; IF <TEMDOC> NOT PRESENT
IF OK.NO
MODE 1.YES
O C
IF 1.YES
TEMDOC = SET 1                ; THEN CREATE IT PREFERRABLY ON DISC

RCMOL = ALGOL TRCMOL          ;


BTEM = ENTRY 20 TEMDOC
BTEM = RCMOL XTEM             ; TRANSLATE TRIMMED PROGRAM TEXT

TRACE = ENTRY 40 TEMDOC
TRACE = ALGOL TTRACE          ; GENERATE PROGRAM FOR ANALYSING TESTOUTPUT

SCOPE USER BTEM TRACE

O TEMDUMMYOUT

CLEAR TEMP XTEM RCMOL TEMTRIM TRCMOL TTEM TTRACE TTEMTEST TEMLOAD TEMSAVE,
      TEMLIST

O C
CLEAR TEMP TEMDUMMYOUT
```