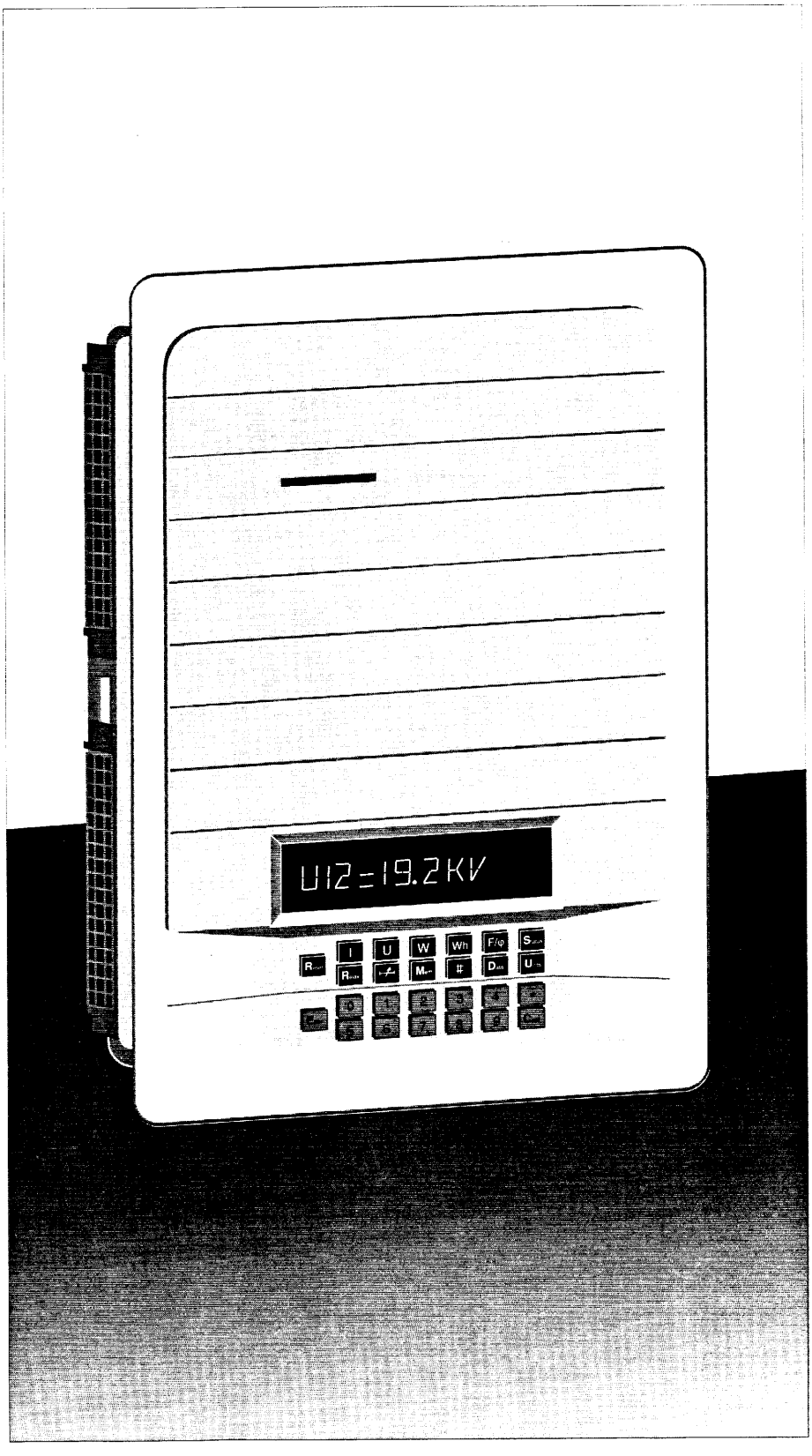
Sepam 15



instruction manual

- ■ serial transmission
- ❒ J BUS protocol

MERLIN GERIN

mastering electrical power

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contents

legend :

 : example of application

Sepam : Sepam 15

☞ : read without fail

physical characteristics

generalities

The Sepam is equipped with an **asynchronous serial transmission coupler** to dialogue with other equipment (programmable controllers, computers,...).
The dialogues use the master-slave process, with the Sepam always considered as the slave station.
Several Sepam's can be connected to the same master station.
The master station can:
■ **ask** Sepam for the following information:
❑ phase current,
❑ zero phase sequence current,
❑ compound voltages,
❑ active/reactive power,
❑ active / reactive energy,
❑ power factor,
❑ frequency,
❑ status of binary inputs and outputs,
❑ internal automation bits,
❑ status of protection and parameters,
❑ time-delay instructions,
❑ status of events counters,
❑ Sepam failures,
❑ remote control bits ,
❑ time dater.

■ **transmit** the orders to the Sepam's to activate the following functions:
❑ open circuit breaker,
❑ close circuit breaker,
❑ reclose,
❑ operating rate,
❑ local or remote operating.

For quick protective action, it is advisable to use the Sepam hard-wired input-outputs rather than its teletransmission connection.

The Sepam identification number, the transmission speed and the line rest state (0 or 20 mA) can be modified for the "status" key of the Sepam keyboard **(see "operating" instructions)**.

☞ **note**: any link passing through public territory must be approved by the relevant authorities.

physical characteristics

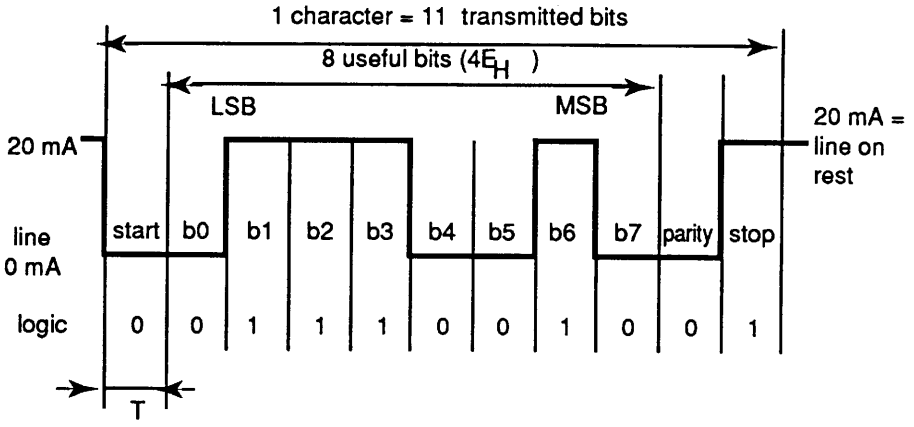
type of link

■ current loop junction:
(0 - 20 mA at rest), passive in the Sepam, active in the master station.

☞ ■ it is possible to choose the following line rest state:
❑ **0** or **20 mA**

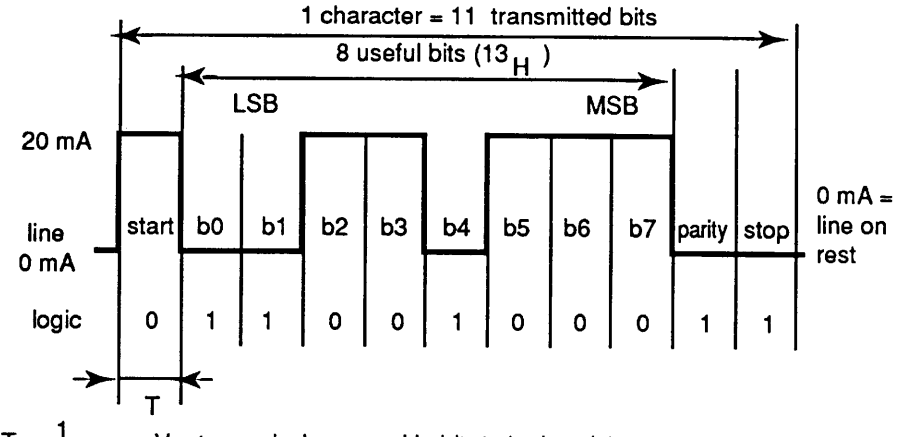
☞ ■ data format:
❑ **11 transmitted bits**: 1 start bit
8 useful bits
(1 byte)
1 even-numbered parity bit
1 stop bit

■ **example of transmission**
❑ transmission of hexadecimal code ($4E_H$) on a 20 mA line on rest.



$T = \frac{1}{V}$ V = transmission speed in bits/s (or bauds)

■ transmission of hexadecimal code (13_H) on a 0 mA line on rest.



$T = \frac{1}{V}$ V = transmission speed in bits/s (or bauds)

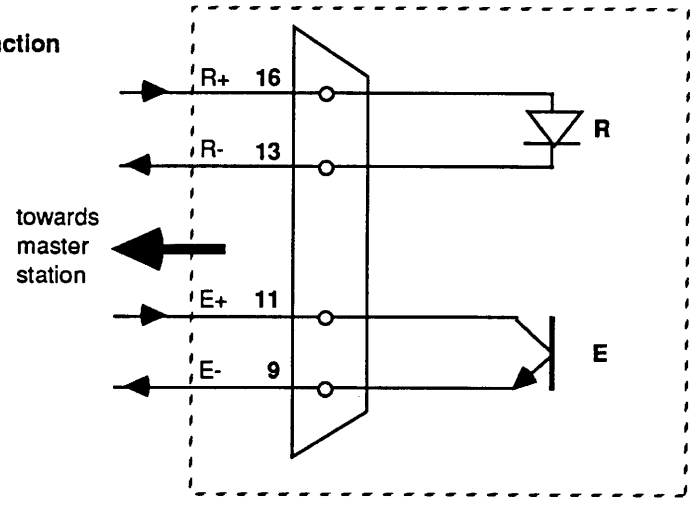
☞ **note:** if the dialogue between the Sepam and the controller is interrupted for more than 15 seconds, the **K 822** bit is forced to 1 in the Sepam.
It returns to zero as soon as the master station interrogates the Sepam.

legend:
LSB: least significant bit
MSB: most significant bit

connection

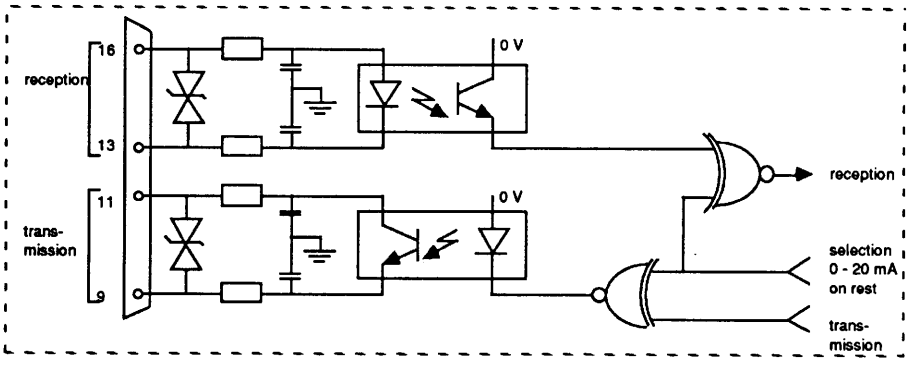
■ output on a 25 pin "SUB D" female connector located on the rear of the SEPAM, marked X6.

wiring diagram
passive current junction



E: transmission
R: reception
+: current entering
-: current leaving

layout diagram



The connection consists of 2 twisted shielded pair cabling with a cross section between 0.22 and 0.6 mm² and a 25 pin "SUB D" male connector with a locked cap (connector delivered in connections bag).

Installation

■ do not use any unnecessary lengths of wire.

☞ The cable shielding braid should be connected at both line ends so that it is exposed to high frequencies and to the electrical field.

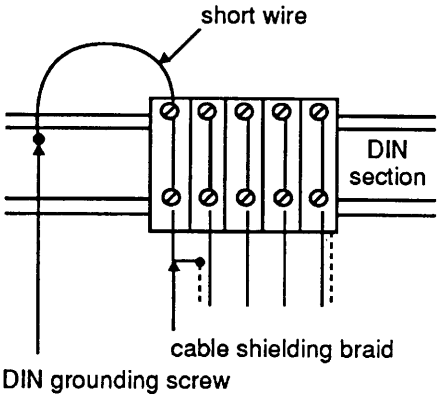
■ the asynchronous link must be connected to the 6 mm terminal block at the back of the LV box.

■ connect the cable shielding to the ground at the junction box using the DIN section attachment screw, with the cable shielding braid (or with a short wire).

■ connect the cable shielding to the ground at the **Sepam** using the SUBD 25-pin connector.

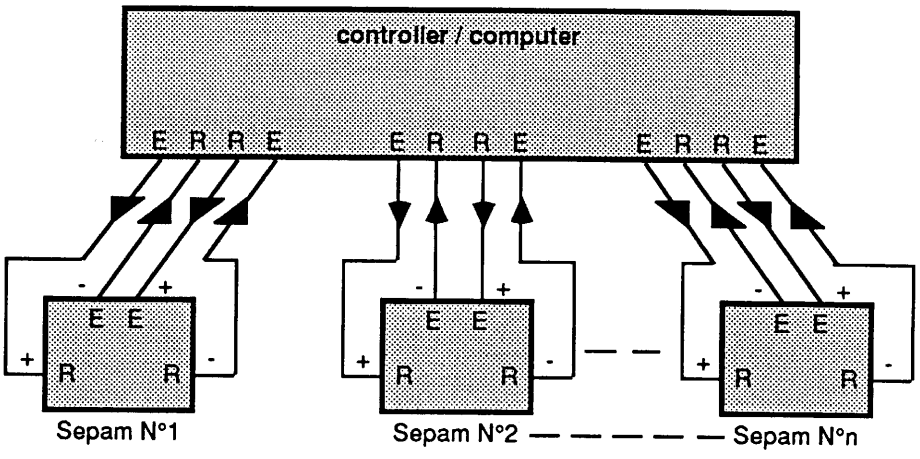
■ inter-assembly connection relative to the asynchronous coupler requires a shielded cable. Connect cable shielding to ground on same terminal block.

connection terminal block

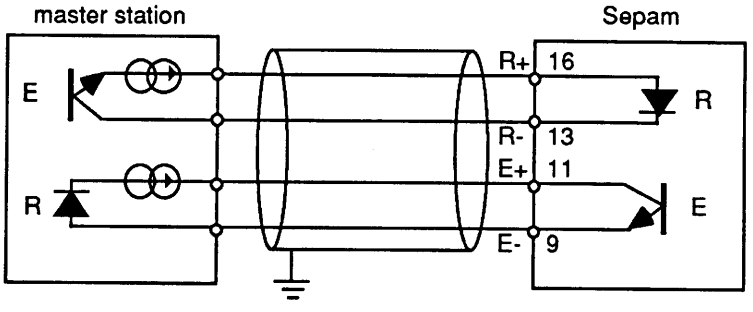


point to point connection (0 or 20 mA on rest)

layout diagram



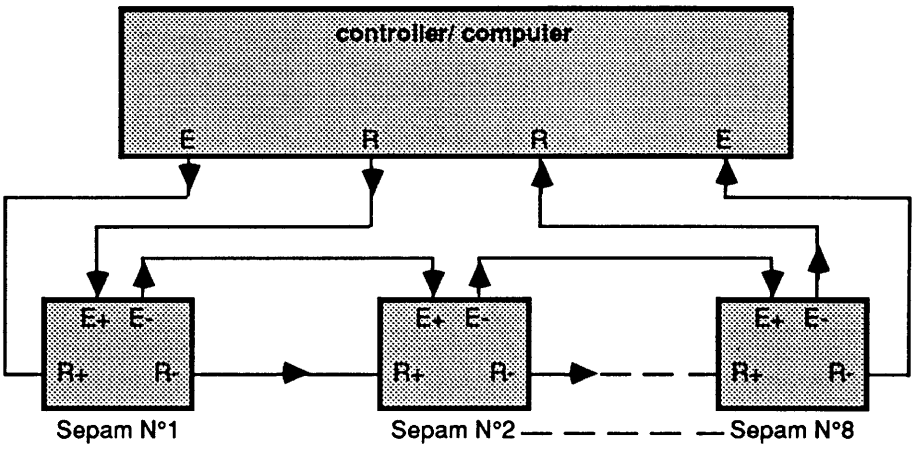
wiring diagram



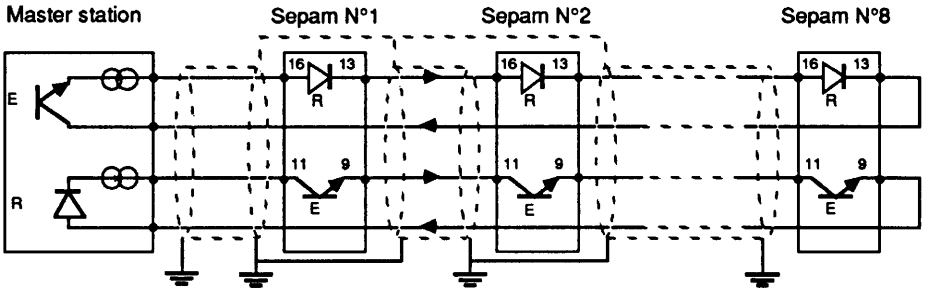
multipoint connection (20 mA on rest)

This type of link provides a permanent check of the continuity of network transmission, through the presence of 20 mA on rest in the line.

layout diagram

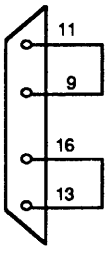


wiring diagram



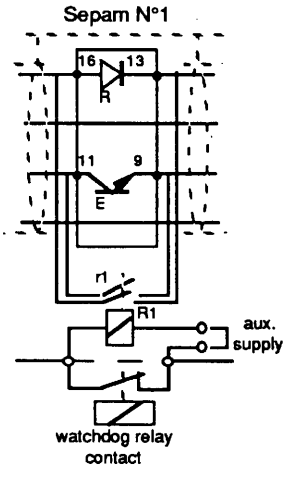
☞ **note**: in order to disconnect the Sepam while in operation, the following are required:

■ either a 25 pin female "SUB D" connector, wired as follows:



■ or couplings on the terminal block.

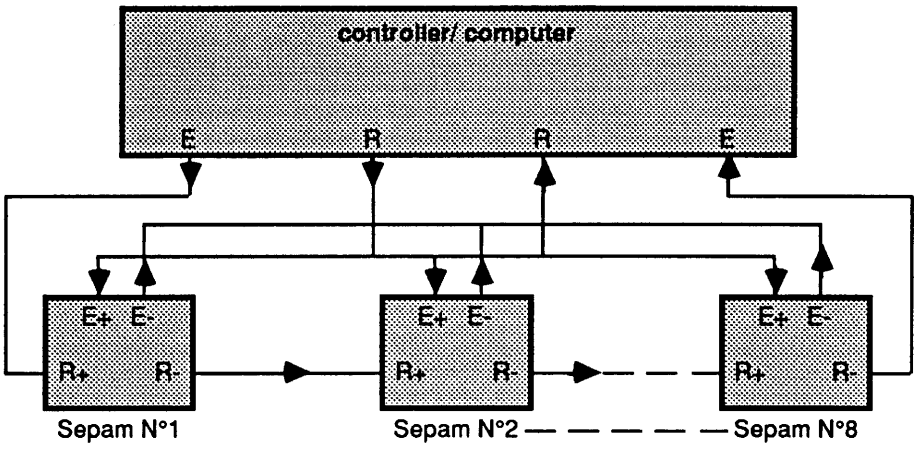
To ensure continuous operating when the Sepam back-up supply is cut off, it is possible to short circuit the Sepam transmission and the Sepam reception by a relay that is activated when the watchdog is released.



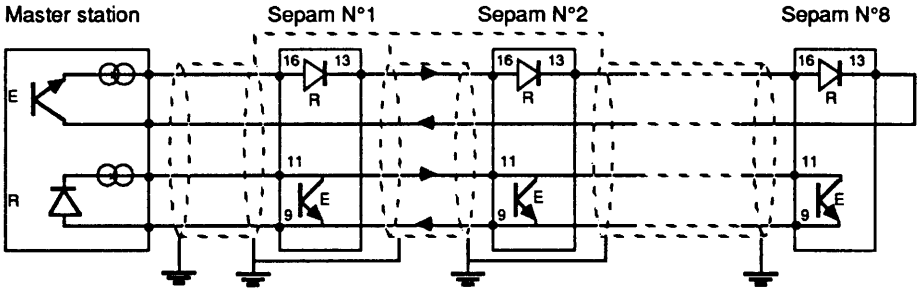
multipoint connection (0 mA on rest)

This type of link enables the Sepam supply to be cut off without disturbing dialogue on the transmission network.

layout diagram

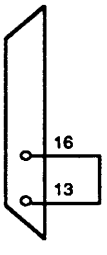


wiring diagram



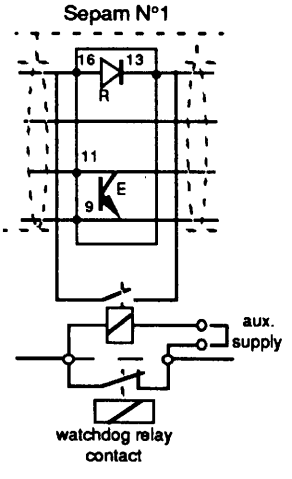
☞ **note**: in order to disconnect the Sepam while in operation, the following are required:

■ either a 25 pin female "SUB D" connector, wired as follows:



■ or a coupling on the terminal block.

To ensure continuous operating when the Sepam back-up supply is cut off, it is possible to short circuit the Sepam reception by a relay that is activated when the watchdog is released.



number of Sepam's on the same loop = n

$$n = \frac{V\,i\,max - (RL \times 0{,}02)}{\Delta u}$$

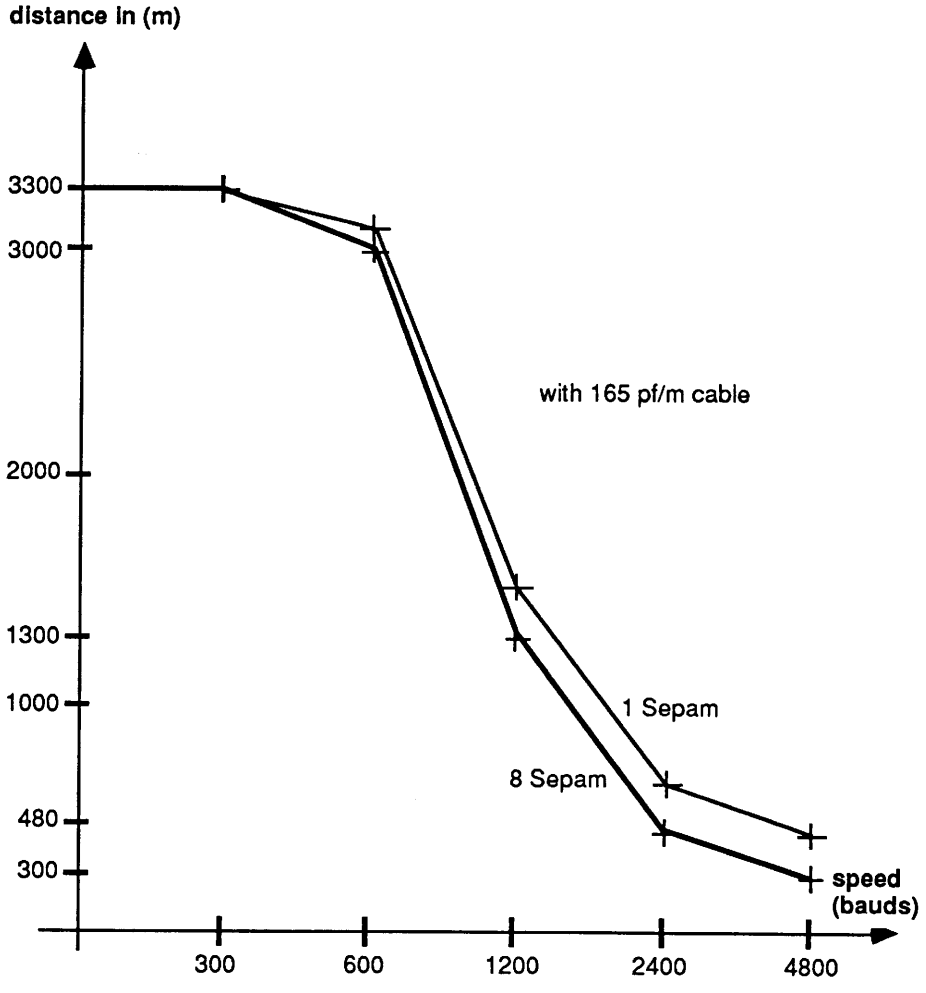
with:
V i max = maximum voltage of the 20 mA current generator
RL = total resistance of the line
Δ u = voltage drop in the Sepam (2v max)

Vi max (v)	RL(Ω)					
	30	60	90	120	240	480
5	n=2	1	1	1		
10	4	4	4	3	2	
15	7	6	6	6	5	2
20	8	8	8	8	7	5
24	8	8	8	8	8	7

note: this table shows that the number of Sepam's on the same loop depends on the current generator voltage.
In practice, **do not connect more than 8 Sepam's** on the same 0 / 20 mA loop for a Vi of 24 volts.

transmission speed

300 - 600 - 1200 - 2400 - 4800 bauds chosen according to the length of the transmission cable, as in the diagram below:



☞ The Sepam transmission speed can be parametered using the "STATUS" key on the Sepam keyboard.

Sepam identification

The Sepam must have a number (from 1 to 255) in order to be recognized by a master station. This number can be parametered using the "STATUS" key on the Sepam keyboard.

☞ Sepam's on the same loop must have different numbers.

diagnosis of a line

If the Sepam replies incorrectly or does not reply at all (except for diffusion messages), check the following points:

- the Sepam is switched on.
- the 25 pin "SUB D" connector is correctly wired on the Sepam
- the Sepam parameters are set properly:
  - slave number from 1 to 255: SEPAM's on the same loop must have different numbers.
  - remote transmission rate: 300 - 600 - 1200 - 2400 - 4800 bauds. The rate must be homogeneous with the rate programmed at the master station.
  - logic level on rest: 0 or 20 mA. The logic level on rest must be the same as at the master station.
- the master station is in the current loop link, active in transmission and reception.
- the master station has a current generator voltage compatible with the number of Sepam's on the loop (see table: "number of Sepam's on the same loop").
- the master station dialogues using the following format: 1 start bit, 8 data bits, 1 even-numbered parity bit, 1 stop bit.
- the numbers of slave stations programmed in the master station are compatible with those programmed on the Sepam. These numbers must be different on the same track (same link) of the master station.
- the time-outs programmed in the master station are properly set. For example, for a 4800 baud measurement reading, the time-out must be more than 500 ms.
- the number of Sepam's on the same loop is less than or equal to 8.
- the wiring used is: 2 shielded twisted pair cable with the lowest possible line capacity (<180 pf/m).
- the length of the transmission cable is compatible with the transmission speed (see "transmission speed" graph).
- the wiring is compatible with the logic level used on rest.

If the line is frequently disturbed, check the following points:

- the cable is of the 2 shielded twisted pair type, and the shielding is grounded on the master station side.
- there is no common point between remote control transmission tracks, notably:
  - on the medium voltage panel,
  - on the asynchronous couplers of the master station,
  - on any supplies for the asynchronous couplers of the master station.

☞ **note**: if the dialogue between the Sepam and the controller is interrupted for more than 15 seconds, the **K 822** bit is forced to 1 in the Sepam. It returns to zero as soon as the master station interrogates the Sepam again.

J BUS protocol

generalities

The JBUS protocol is used to read or write one or several bits, one or several words, the contents of the events or diagnosis counters.
9 functions are available on Sepam:

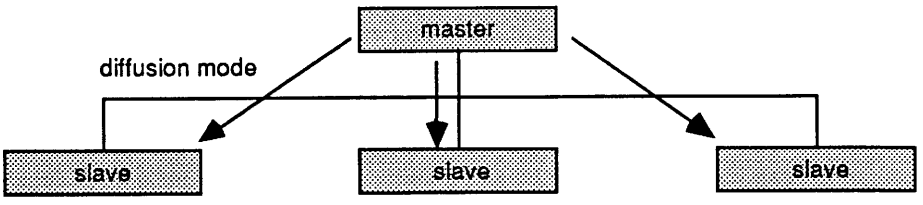
- reading of n bits,
- reading of n words,
- writing of a bit,
- writing of a word,
- rapid reading of 8 bits,
- reading of diagnosis counters,
- reading of event counter,
- writing of n bits,
- writing of n mots.

In J BUS, the master station initiates the dialogue which consists of a request from the master station and the reply from the slave station.

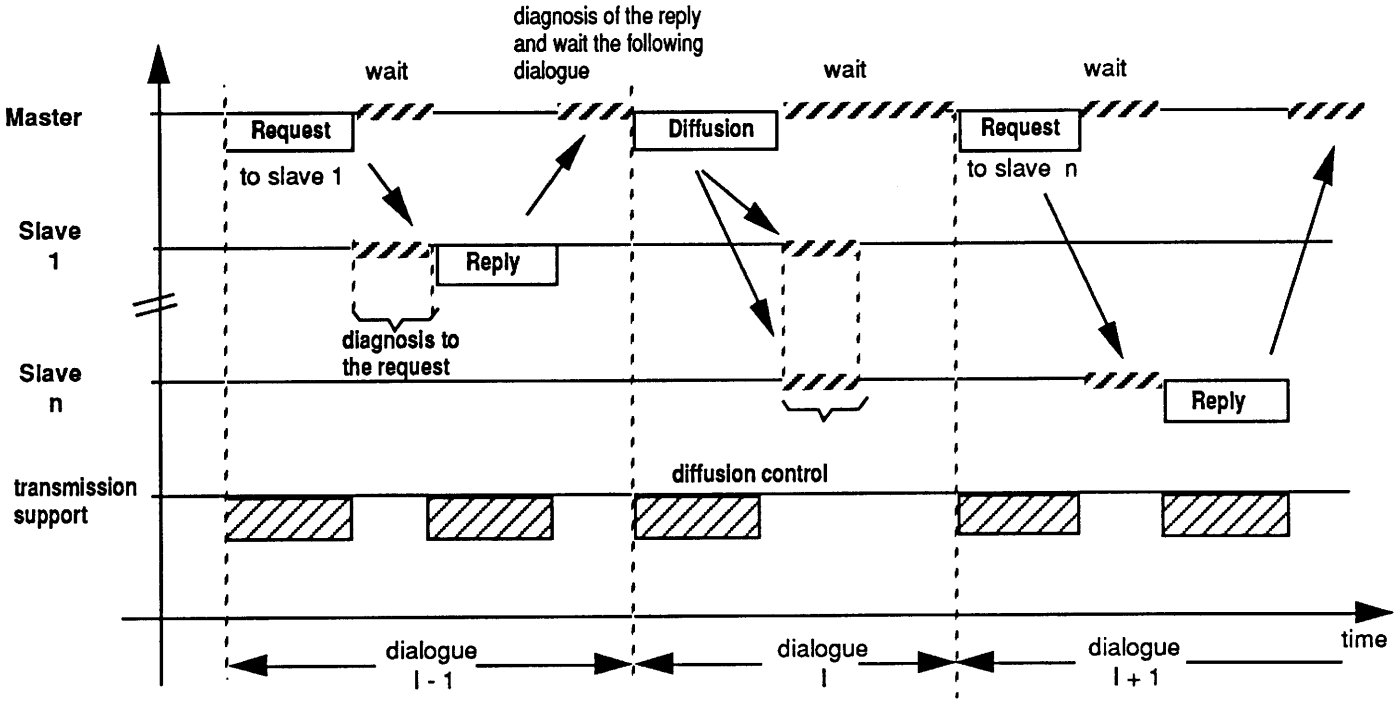
All the procedures exchanged have the same structure.

slave number	function code	data area	test area (CRC 16)

Master station requests are either sent to a given slave station (identified by its number in the first byte of the request procedure) or sent out to all the slaves (diffusion).
The diffusion controls must be writing controls. Then the slaves do not reply.



occupation diagram of the transmission support with J BUS



☞ **note :** the duration of the requests, replies, diffusion, wait, **depends on the function performed.**

basic principle

Each dialogue consists of two messages: a request from the master and a reply by the slave.
The master always initiates the interrogation.

☞ **The information is transmitted in hexadecimal form.**

There are four types of information:
■ **bit**: the smallest unit of information transmissible on the asynchronous series link. A bit can have two values: 1 or 0
■ **byte**: a set of 8 consecutive bits.

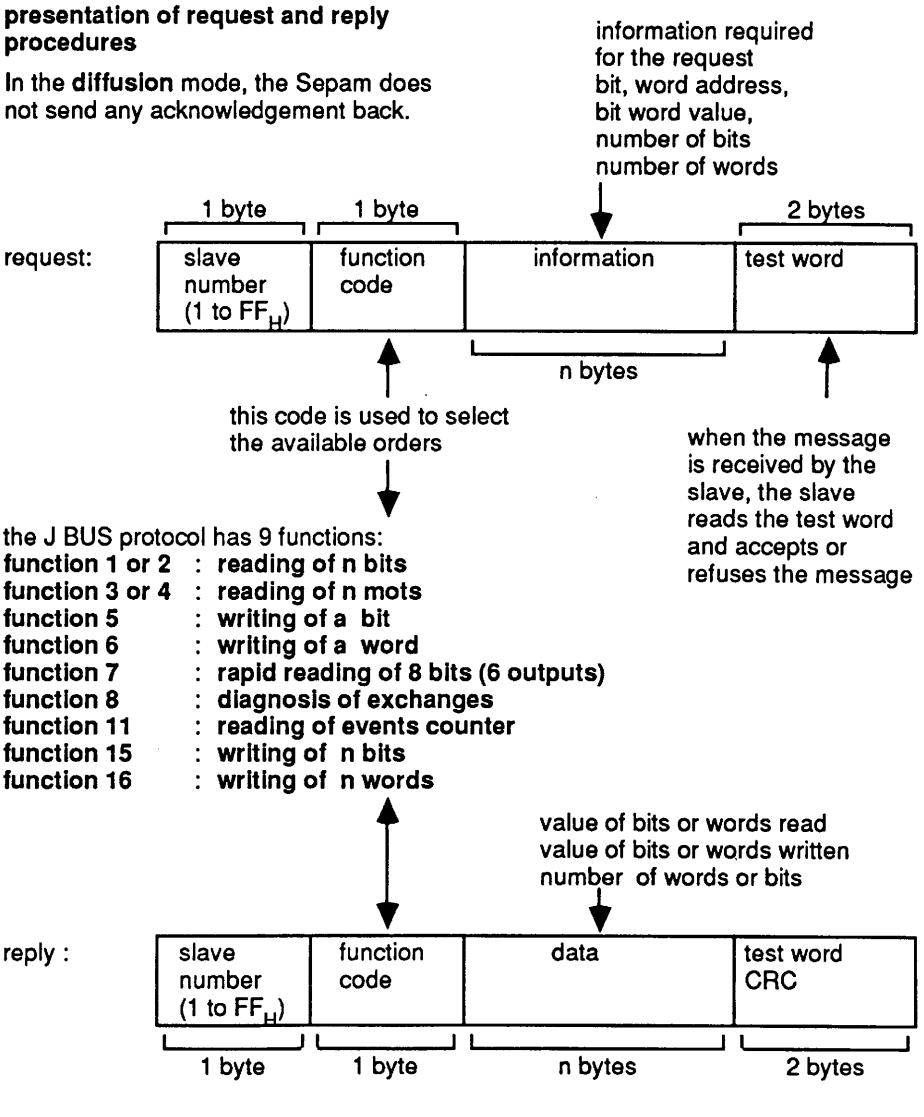
■ **word**: a set of 2 bytes or 16 consecutive bits.

Each message or procedure contains 4 types of information:

■ **slave station number** (1 byte)
The slave number specifies the Sepam
☞ addres see (1 to FF).
If the slave number is at 0, the request concerns all the slaves.
Thus there is no reply message (diffusion mode).
■ **function code** (1 byte)
It is used to select an order and to check if the reply is correct.
■ **data area** (n bytes)
The data area contains the parameters related to the function: bit address, bit value, bit value, word value, number of bits, number of words.
■ **test word** (2 bytes)
It is a CRC 16 type and it is used to detect transmission errors (see annex III).

☞ **presentation of request and reply procedures**

In the **diffusion** mode, the Sepam does not send any acknowledgement back.



The Sepam asynchronous coupler fills and sends out the reply without any user intervention.

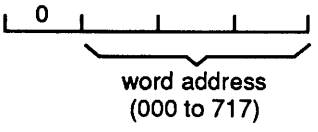
information

address

J BUS addressing is done on two bytes.

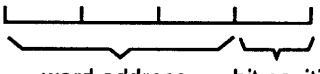
☞ **word addressing**

J BUS word addressing is in accordance with the hexadecimal addresses of the J BUS field (see"information: J BUS field").



☞ **bit addressing**

Bit addressing is as follows:



example:
the word address of remote control bits is 0012_H and the internal K782 bit address is 0121_H.

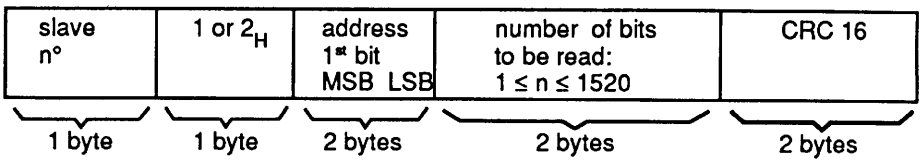
functions

reading of n consecutive bits

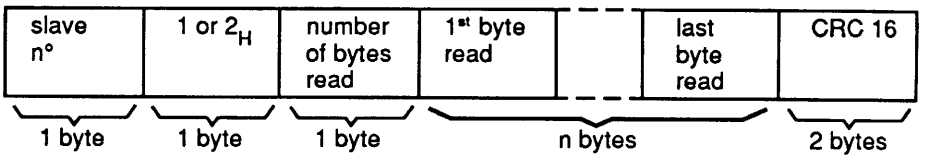
function 1 or 2

The number of bits to be read must be ≤ 1520 in the Sepam. Functions 1 and 2 are managed similarly by the Sepam.

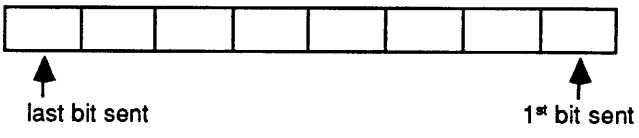
request



reply



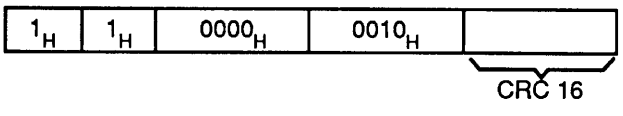
breakdown of a byte:



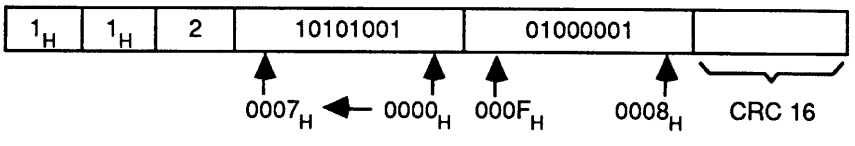
The bits that are not used in the byte are set at zero.

example:
reading of the 16 diagnosis bits of Sepam N°1 (word 0000_H).

request



reply



reading of n consecutive words

function 3 or 4

The number of words to be read must be ≤ 95. Functions 3 and 4 are managed similarly by the Sepam.

request

slave n°	3 or 4_H	address 1st word MSB LSB	number of words to be read: 1 ≤ n ≤ 95 MSB LSB	CRC 16 MSB LSB
1 byte	1 byte	2 bytes	2 bytes	2 octets

reply

slave n°	3 or 4_H	number of bytes read	value 1st word		value last word MSB LSB	CRC 16 MSB LSB
1 byte	1 byte	1 byte	2 bytes		2 bytes	2 bytes

example:
reading of time delays and protection limits 1, 2 and 3 of Sepam N°2.

request

2_H	3_H	0300_H	0006_H	
				CRC 16

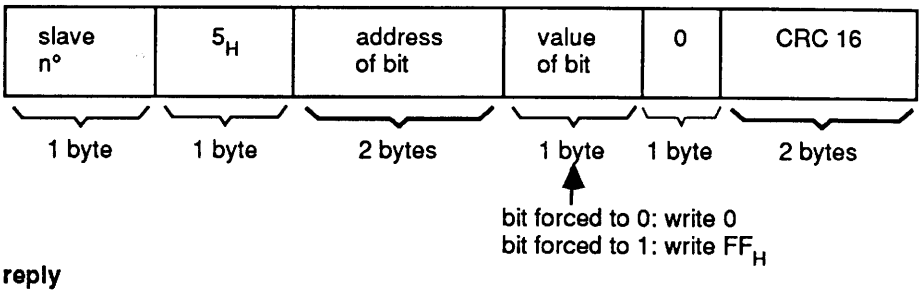
reply

2_H	3_H	$0C_H$	XXXX		ZZZZ	
			value of word 0300_H		value of word 0305_H	CRC 16

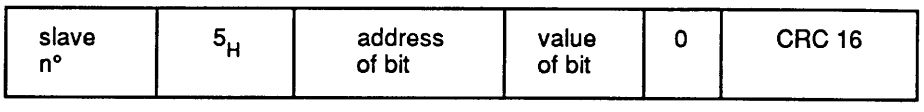
writing of a bit

function 5
This order can be carried out by diffusion in which case no reply is sent.

request



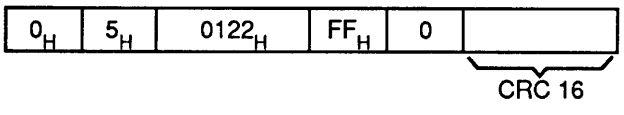
reply



For function 5, the reply procedure is the same as the request procedure.

example:
forcing to 1 of K 783 bit on all Sepam's
(see information: J BUS field).

request/reply

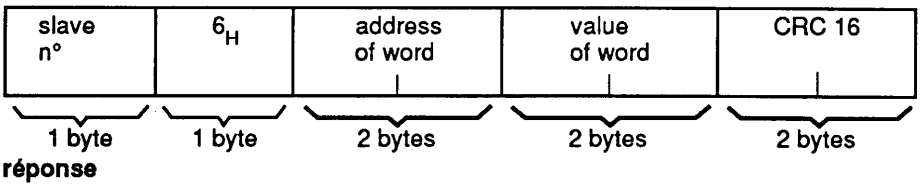


writing of a word

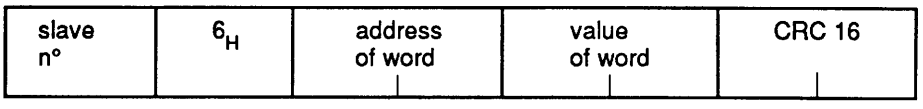
function 6

This order can be carried out by diffusion in which case no reply is sent.

request



réponse

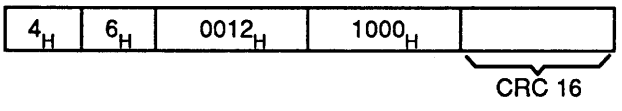


The reply echoes the request, indicating that Sepam has taken into consideration the value contained in the request.

This order can be carried out in the diffusion mode.

example:
writing of 1000_H in the remote control word of Sepam N° 4 at the 0012_H address.

request / reply

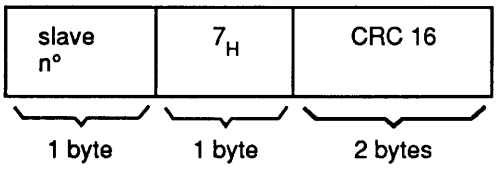


rapid reading of 8 bits

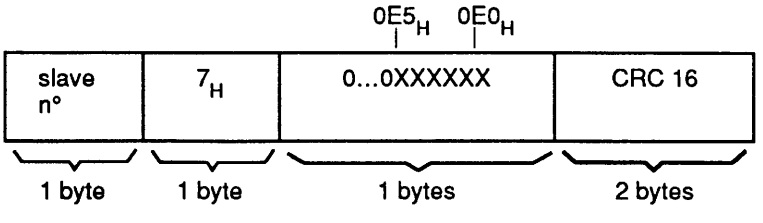
function 7

This function requires **an 8-bit word** to be predefined in the Sepam coupler.
In the Sepam, the bits affected are those from $0E0_H$ to $0E5_H$.
The bits $0E6_H$ and $0E7_H$ are at 0.

request



reply



reading of diagnosis counters

function 8

8 diagnosis counters, 16 bits each, are assigned to each Sepam.
These counters are updated by Sepam upon every exchange.
They are set at zero when the back-up supply is cut off.

1st counter:
It contains the number of requests correctly received by the Sepam (no CRC error), whether it is concerned or not (message counter).
2nd counter:
It contains the number of requests received with a CRC error.
3rd counter:
It contains the number of exception replies sent back by the slave (or not sent back in the case of diffusion).
4th counter:
It contains the number of correct requests specifically addressed to the slave (apart from diffusion).
5th counter:
It contains the number of requests for diffusion received and correctly processed.
6th counter:
It contains the number of "Sepam not ready" replies sent back by the Sepam.
7th counter:
It contains the number of wrong characters (format, parity...) received by the Sepam.
8th counter:
It contains the number of requests received by the slave and carried out correctly (event counter).
Type of request:
- variable write,
- variable read,
- diffusion,
- reading of every counter except the last one.

order syntax:

slave n°	8_H	code in function	data	CRC 16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

reading of total number of :

■ procedures received with no CRC errors (CPT 1)	0B	XXXX	
■ procedures received with CRC error (CPT 2)	0C	XXXX	during request,
■ number of exception replies (CPT 3)	0D	XXXX	XXXX is equal
■ procedures sent to station (CPT 4) (besides diffusion)	0E	XXXX	to 00 00 during
■ diffusion requests received (CPT 5)	0F	XXXX	response,
■ reply: controller not ready (CPT 6)	10	XXXX	XXXX is the
■ characters not processed (CPT 7)	12	XXXX	contents of the counter involved

This diagnosis order is **not allowed** in the **repetitive mode.**

example:
number of diffusion requests received by Sepam N° 3

request

3_H	8_H	00 $0F_H$	00 00_H	CRC 16

reply : 8 diffusions received.

3_H	8_H	00 $0F_H$	00 08_H	CRC 16

reading of events counters

function 11

Each Sepam has an event counter (8^{th} counter).

The master also has an event counter. The event counter is incremented each time a procedure is received and interpreted by Sepam except for the reading of this counter.
function 11.

An accurate diffusion order increments the counter. If the slave sends back an exception reply, the counter is not incremented.

This counter is used to find out from the master whether the slave has interpreted the order properly (event counter incremented) or not (counter not incremented).

The reading of these different elements permits diagnosis of master and slave dialogue.

If the master counter = the slave counter, the order sent by the master has been carried out.
If the master counter = the slave counter +1, the order sent by the master has not been carried out.

request

slave n°	$0B_H$	CRC 16

reply

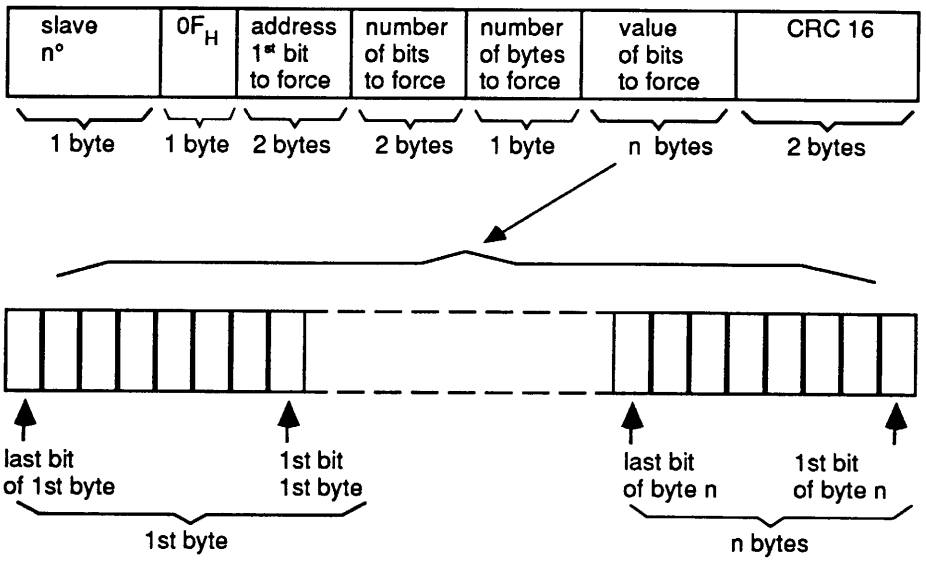
slave n°	$0B_H$	0	contents of slave counter	CRC 16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

writing of n consecutive bits

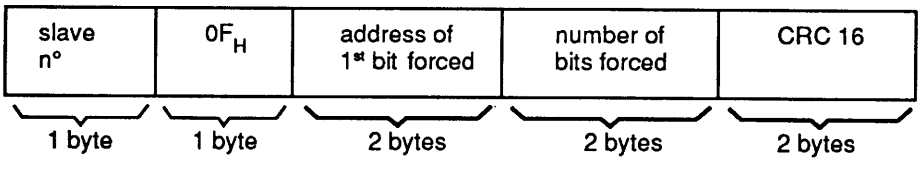
function 15

This order can be carried out by diffusion in which case no reply is sent. The number of consecutive bits to be forced must be ≤ **16 in Sepam**. As a result, a single word can be forced. This order is accessible in the diffusion mode.

request

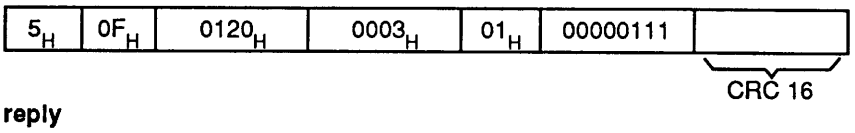


reply

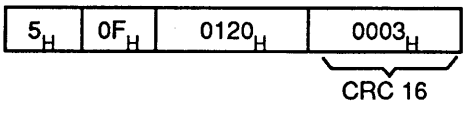


example:
force to 1 the 3 first bits of the word 0012_H of the remote control of Sepam N°5

request



reply

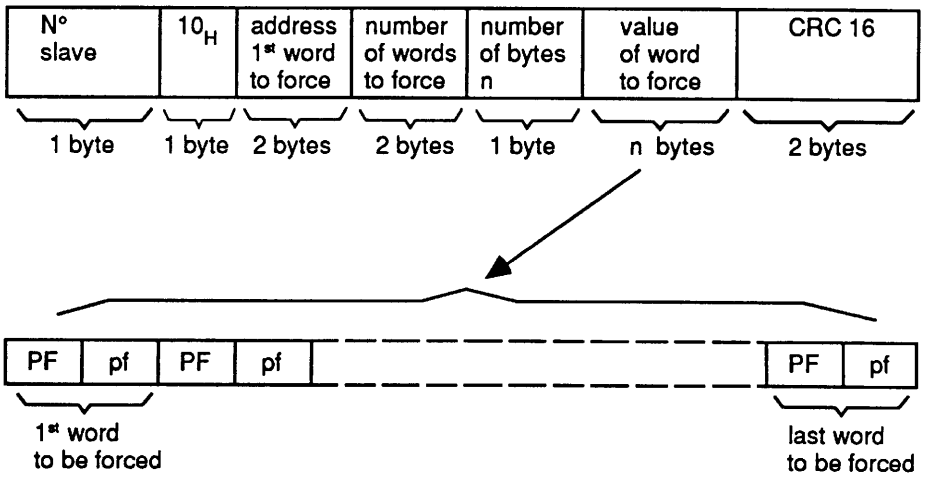


writing of n consecutive words

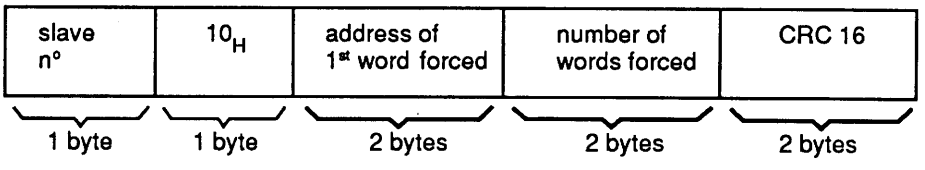
function 16

This order can be carried out by diffusion in which case no reply is sent.
Only one word can be forced at a time.
Only two words are accessible in writing, addressed at 012_H and 600_H.
Since each word has 16 bits, the number of bytes to be forced must be **≤ 2.**
This order is accessible in the diffusion mode.

request



reply



example:
writing of remote control bits in Sepam N°7.

request

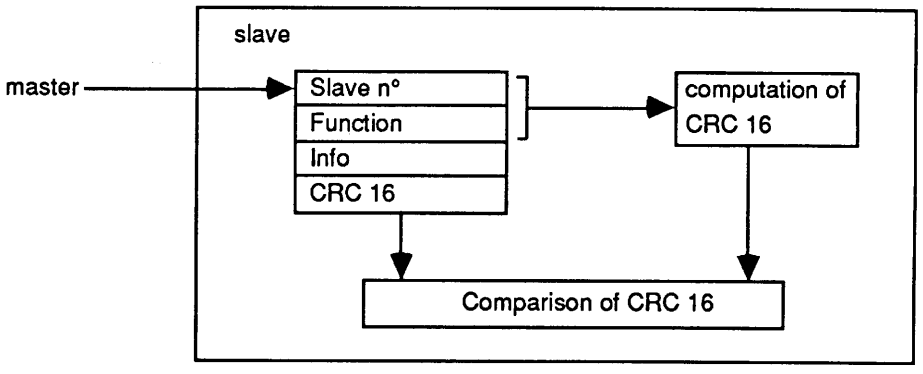
07_H	10_H	0012_H	0001_H	1005_H	CRC16

reply

07_H	10_H	0012_H	0001_H	CRC16

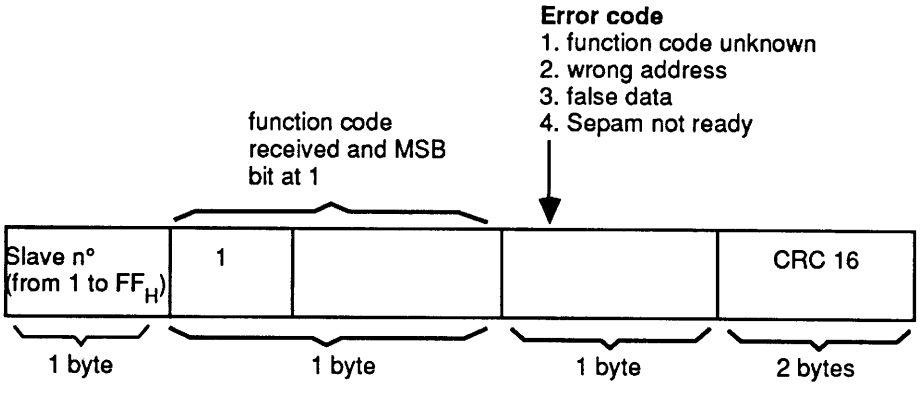
J BUS transmission error

When the Sepam asynchronous coupler receives a message, it stores it, computes the CRC 16 and compares it with the CRC 16 received.



☞ If the message received is **wrong** (CRC 16's not equal), the Sepam does not reply.
If the message received is correct but the Sepam cannot process it (wrong address, false data ...), it sends back an error message.
If the Sepam receives a procedure with a correct CRC but that is too short or too long, the Sepam processes the procedure until it detects any incoherency.

contents of an error message



example :

request

1_H	9_H	0	0	0	0	CRC 16

reply

1_H	89_H	1	CRC 16

J BUS field

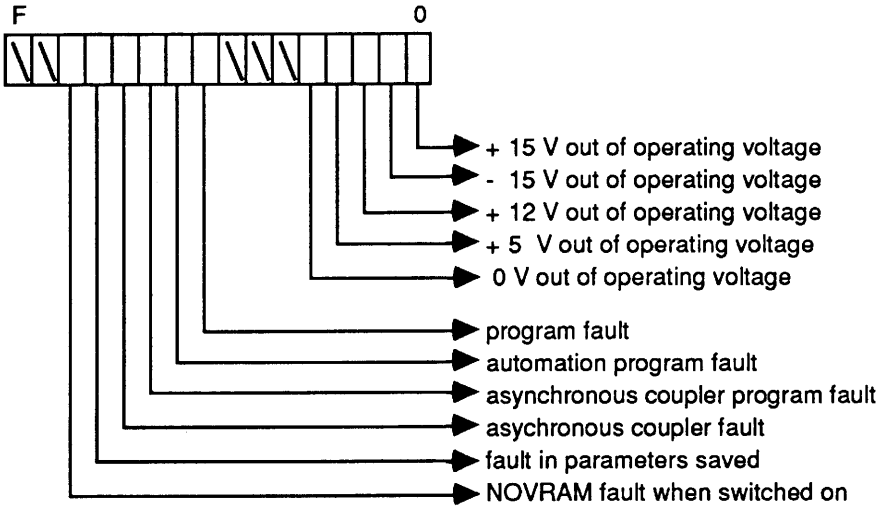
hexa address	wording MSB 15.....8	LSB / 7.....0	word access	bit access
0000	diagnosis : word 1		L	L
0001	diagnosis : word 2		L	L
0002	K16	K1	L	L
0003	K32	K17	L	L
0004	K48	K33	L	L
0005	K64	K49	L	L
0006	K80	K65	L	L
0007	K96	K81	L	L
0008	K112	K97	L	L
0009	K128	K113	L	L
000A	K144	K129	L	L
000B	T16.....	T1	L	L
000C	/ / / / / / / / C8	C1	L	L
000D	/ / / / / / / / I8	I1	L	L
000E	/ / / / / / / / 06	01	L	L
000F	K716	K701	L	L
0010	K732	K717	L	L
0011	K748	K733	L	L
0012	K796	K781	L/E	L/E
0013	K828	K813	L	L
0014	K844	K829	L	L
0015	K860	K845	L	L
0016	K876	K861	L	L
0017	K892	K877	L	L
0018	K908	K893	L	L
0019	K924	K909	L	L
001A	K940	K925	L	L
001B | | | 00FF				

note: L = reading access
E = writing access

note: see "programming" instructions for the meaning of each bit.

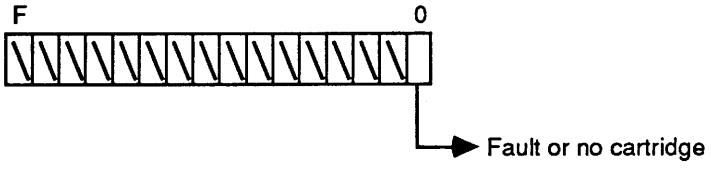
diagnosis word 1 (00_H):

there is a fault if the bit is at 1



diagnosis word 2 (01_H):

there is a fault if the bit is at 1



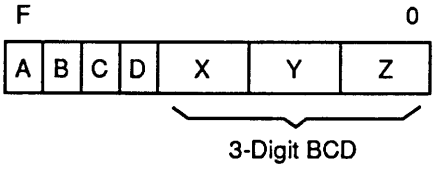
Note: each of these faults is indicated by the "fault" message on the Sepam display unit.

hexa address	wording MSB 15.....8	LSB / 7.....0	word access	bit access
0200	F28.....F21	/ F18.....F11	L	L
0201	F48 F41	/ F38 F31	L	L
0202	F68 F61	/ F58 F51	L	L
0203	F88 F81	/ F78 F71	L	L
0204	F108 F101	/ F98 F91	L	L
0205	F128 F121	/ F118 F111	L	L
0206	F148 F141	/ F138 F131	L	L
0207	F168 F161	/ F158 F151	L	L
0208	F188 F181	/ F178 F171	L	L
0209	F208 F201	/ F198 F191	L	L
020A	F228 F221	/ F218 F211	L	L
020B	F248 F241	/ F238 F231	L	L
020C	F268 F261	/ F258 F251	L	L
020D	F288 F281	/ F278 F271	L	L
020E	F308 F301	/ F298 F291	L	L
020F	F328 F321	/ F318 F311	L	L
0210	F348 F341	/ F338 F331	L	L
0211	F368 F361	/ F358 F351	L	L
0212	F388 F381	/ F378 F371	L	L
0213	F408 F401	/ F398 F391	L	L
0214	F428 F421	/ F418 F411	L	L
0215	F448 F441	/ F438 F431	L	L
0216	F468 F461	/ F458 F451	L	L
0217	F488 F481	/ F478 F471	L	L
0218	F508 F501	/ F498 F491	L	L
0219	F528 F521	/ F518 F511	L	L
021A	F548 F541	/ F538 F531	L	L
021B	F568 F561	/ F558 F551	L	L
021C	F588 F581	/ F578 F571	L	L
021D	F608 F601	/ F598 F591	L	L
021E	F628 F621	/ F618 F611	L	L
021F	F648 F641	/ F638 F631	L	L
0220	F668 F661	/ F658 F651	L	L
0221	F688 F681	/ F678 F671	L	L
0222	F708 F701	/ F698 F691	L	L
0223	F728 F721	/ F718 F711	L	L
0224	F748 F741	/ F738 F731	L	L
0225	F768 F761	/ F758 F751	L	L
0226	F788 F781	/ F778 F771	L	L
0227	F808 F801	/ F798 F791	L	L
0228	F828 F821	/ F818 F811	L	L
0229	F848 F841	/ F838 F831	L	L
022A	F868 F861	/ F858 F851	L	L
022B	F888 F881	/ F878 F871	L	L
022C	F908 F901	/ F898 F891	L	L
022D	F928 F921	/ F918 F911	L	L
022E	F948 F941	/ F938 F931	L	L
022F	F968 F961	/ F958 F951	L	L
0230	F988.....F981	/ F978.....F971	L	L
0231	/ / / / / / / / / /	/ F998.....F991	L	L
0232				
⋮				
02FF				

hexa address	wording MSB LSB 15.....8 / 7.....0	format	unit	word access	bit access
0300	timer F1	binary	10ms	L	
0301	threshold F1	bcd sgn	amp	L	
0302	timer F2	binary	10ms	L	
0303	threshold F2	bcd sgn	amp	L	
0304	timer F3	binary	10ms	L	
0305	threshold F3	bcd sgn	amp	L	
0306	timer F4	binary	10ms	L	
0307	threshold F4	bcd sgn	amp	L	
0308	timer F8/F15 exclusive	binary	10ms	L	
0309	threshold F8/F15	bcd sgn	amp	L	
030A	timer F9 /F16 exclusives	binary	10ms	L	
030B	threshold F9/F16	bcd sgn	amp	L	
030C	timer F10/F17 exclusives	binary	10ms	L	
030D	threshold F10/F17	bcd sgn	amp	L	
030E	timer F11/F18 exclusives	binary	10ms	L	
030F	threshold F11/F18	bcd sgn	amp	L	
0310	timer F22/F23/F24	binary	10ms	L	
0311	threshold F22/F23/F24	bcd sgn	amp	L	
0312				L	
0313	RESERVED			L	
0314				L	
0315				L	
0316	timer F45	binary	10ms	L	
0317	threshold F45	bcd sgn	amp	L	
0318	timer F46	binary	10ms	L	
0319	threshold F46	bcd sgn	amp	L	
031A	Number of heat starting total F42	binary		L	
031B	starting timer F44	binary	10ms	L	
031C	stalling timer F44	binary	10ms	L	
031D	/ / / / / / SL. alarm. F43	binary	in %	L	
031E	tripping / time	binary	in %	L	
	threshold / constant F43		mn	L	
031F	timer F32/F34/F36	binary	10ms	L	
0320	threshold F32/F34/F36	bcd sgn	volts	L	
0321	timer F33/F35/F37	binary	10ms	L	
0322	threshold F33/F35/F37	bcd sgn	volts	L	
0323				L	
0324				L	
0325				L	
0326	RESERVED			L	
0327				L	
0328				L	
0329				L	
032A				L	
032B	timer F30	binary	10ms	L	
032C	threshold F30	bcd sgn	volts	L	
032D	timer F31	binary	10ms	L	
032E	threshold F31	bcd sgn	volts	L	
032F	timer F49	bcd sgn	amp	L	

address hexa	wording MS 15.....8 / LS 7.....0	format	unit	word access	bit access
0330	RESERVED			L	
0331	timer F50	binary	10 ms	L	
0332	RESERVED			L	
0333	char. angle F 50 //////////////	binary	degree	L	
0334	reference value of 10 Ir / In for F5 , F6 , F7	binary		L	
0335	curve n° F5 / curve n° F6	binary		L	
0336	curve n° F7 //////////////	binary		L	
0337	reference value of 10 Io / In for F12, F13 ,F14	binary		L	
0338	curve n° F12 /curve n° F13	binary		L	
0339	curve n° F14 //////////////	binary		L	
033A	timer F51	binary	10 ms	L	
033B	RESERVED			L	
033C	angle F51 //////////////			L	
035D	RESERVE			L	
033E	RESERVED			L	
033F	max. short circuit / currentIcc /	choice of circuit breaker		L	
034O	RESERVED			L	
0341	reference value of 10 Ir/In for F25, F26, F27	binary		L	
0342	curve n° F25 / curve n° F26	binary		L	
0343	curve n° F27 //////////	binary		L	
0344 | | 035F	RESERVED			L | | L	
0360 | | 03FF					
0400	heating / / / / / / / / / of motor / / / / / / / / /	binary		L	
0403 | 043F	RESERVED			L L	
0440 | 04FF					

■ **thresholds are in the BCD "signed" format (bcd sgn):**



A	B	position of the comma
0	0	XYZ
0	1	XY, Z
1	0	X, YZ
1	1	------

C	D	multiplier
0	0	1
0	1	1 000
1	0	1 000 000
1	1	1 000 000 000

example:

1	0	0	1	2	7	4

2,74 . 10^3 amperes = 2740 amperes

A	B	position of the comma
0	0	274
0	1	27, 4
1	0	2, 74
1	1	------

C	D	multiplier
0	0	10^0
0	1	10^3
1	0	10^6
1	1	10^9

■ **time is in binary base 10 ms.**

example:

0	3	E	8

$3E8_H$ = 1000 x 10 ms = 10 seconds

hexa address	wording MSB 15.....8 / LSB 7.....0	format	unit	word access	bit access
0500	phase current I1	bcd sgn	amp.	L	
0501	phase current I2	bcd sgn	amp.	L	
0502	phase current I3	bcd sgn	amp.	L	
0503	zero sequence current Io	bcd sgn	amp.	L	
0504	max. demand I1 Im1	bcd sgn	amp.	L	
0505	max. demand I2 Im2	bcd sgn	amp.	L	
0506	max. demand I3 Im3	bcd sgn	amp.	L	
0507	phase voltage U 21	bcd sgn	volt	L	
0508	phase voltage U 32 (*)	bcd sgn	volt	L	
0509	phase voltageU 13	bcd sgn	volt	L	
050A	active power P	bcd sgn	watt	L	
050B	reactive power Q	bcd sgn	var	L	
050C	signs / status words			L	
050D	maximeter P mP	bcd sgn	watt	L	
050E	maximeter Q mQ	bcd sgn	var	L	
050F	active energy	bcd	watt.h	L	
0510	counter (+)	12		L	
0511		digits		L	
0512	energy counter	bcd	watt.h	L	
0513	active (-)	12		L	
0514		digits		L	
0515	reactive energy	bcd	var.h	L	
0516	counter (+)	12		L	
0517		digits		L	
0518	reactive energy	bcd	var.h	L	
0519	counter (-)	12		L	
051A		digits		L	
051B	power factor	3 digits		L	
051C	frequency	bcd sgn	Hz	L	
051D | | 05FF					

* replace U32 by U0 for the 312 version

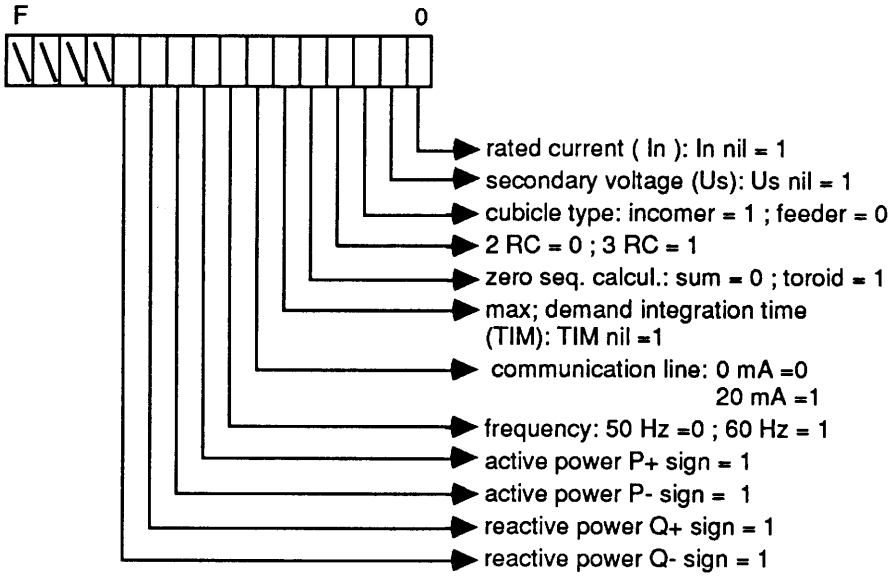
■ The energy counters are in BCD signed format using 12 digits

example:

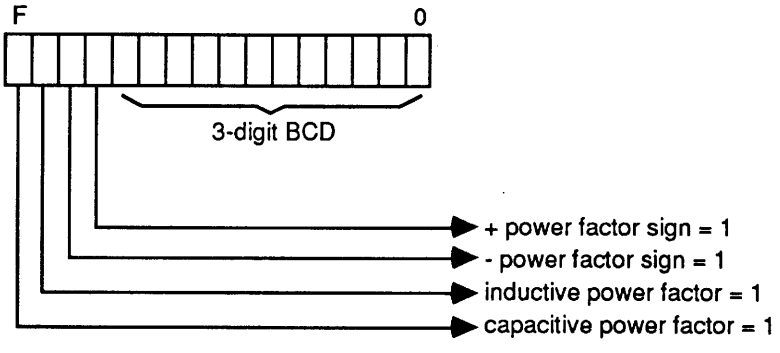
0	1	7	6
3	5	2	7
8	6	4	3

17635278643 Wh

sign / status word (50 C_H):



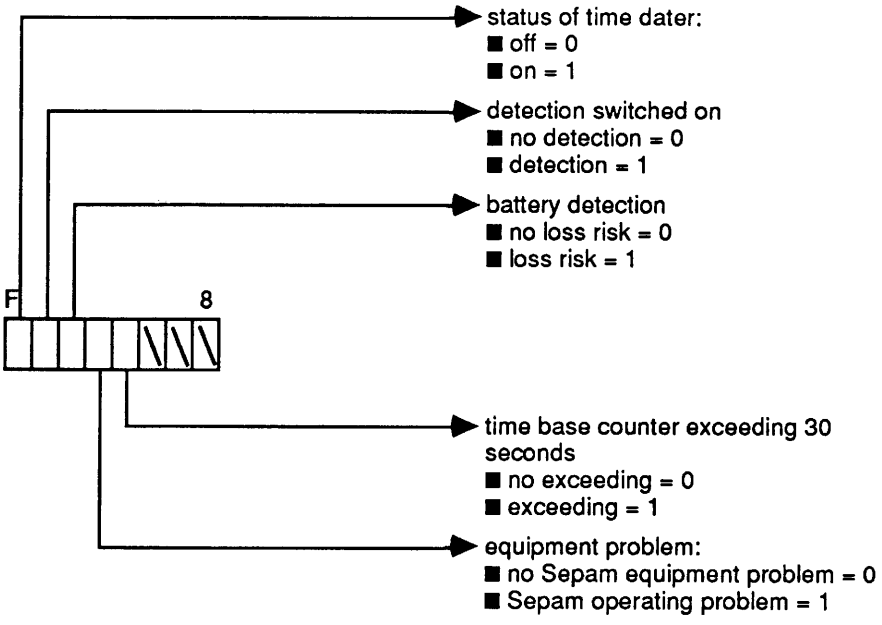
power factor (51 B_H):



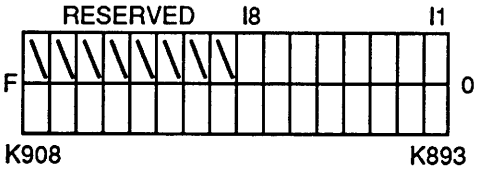
hexa address	wording MSB 15.....8	LSB / 7.....0	word access	bit access
0600	Order n°	Message n°	L /E	
0601	Sepam n°	Message n°	L	
0602	operating bits	number of events	L	
0603	event 0			
0604			L	
0605	event 1			
0606			L	
0607	event 2			
0608			L	
0609	event 3			
060A			L	
060B	event 4			
060C			L	
060D	event 5			
060E			L	
060F	event 6			
0610			L	
0611	event 7			
0612			L	
0613	event 8			
0614			L	
0615	event 9			
0616			L	
0617	event 10			
0618			L	
0619	event 11			
061A			L	
061B	event 12			
061C			L	
061D	event 13			
061E			L	
061F	event 14			
0620			L	
0621	event 15			
0622			L	
0623	time base counter		L	
0624	register E		L	L
0625			L	L
0626	register V		L	L
0627			L	L
0628	register E		L	L
0629	stored on initialization		L	L
062A	register V		L	L
062B	stored on initialization		L	L
062C			L	L
|	RESERVED			
|				
062E			L	L
062F				
|				
|				
|				
06FF				

☞ **note**: the 600_H to $6FF_H$ area in the J BUS address field is reserved for the Sepam timedater function (see chronology instructions).

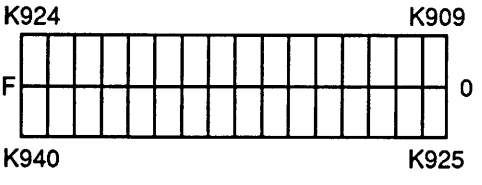
operating bits (602_H):



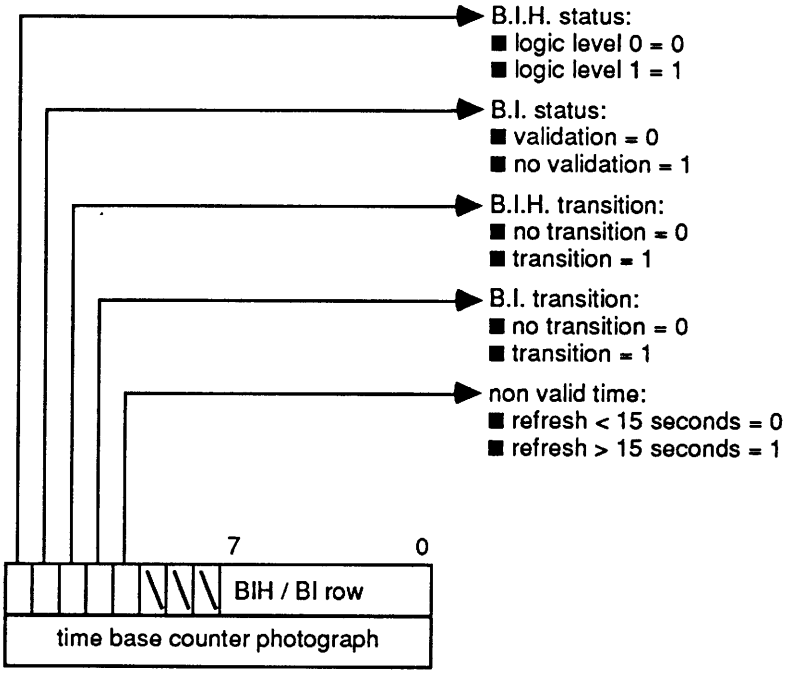
register E (624_H/625_H et 628_H/629_H):



register V (626_H/627_H et $62A_H$/$62B_H$):



format of an event:



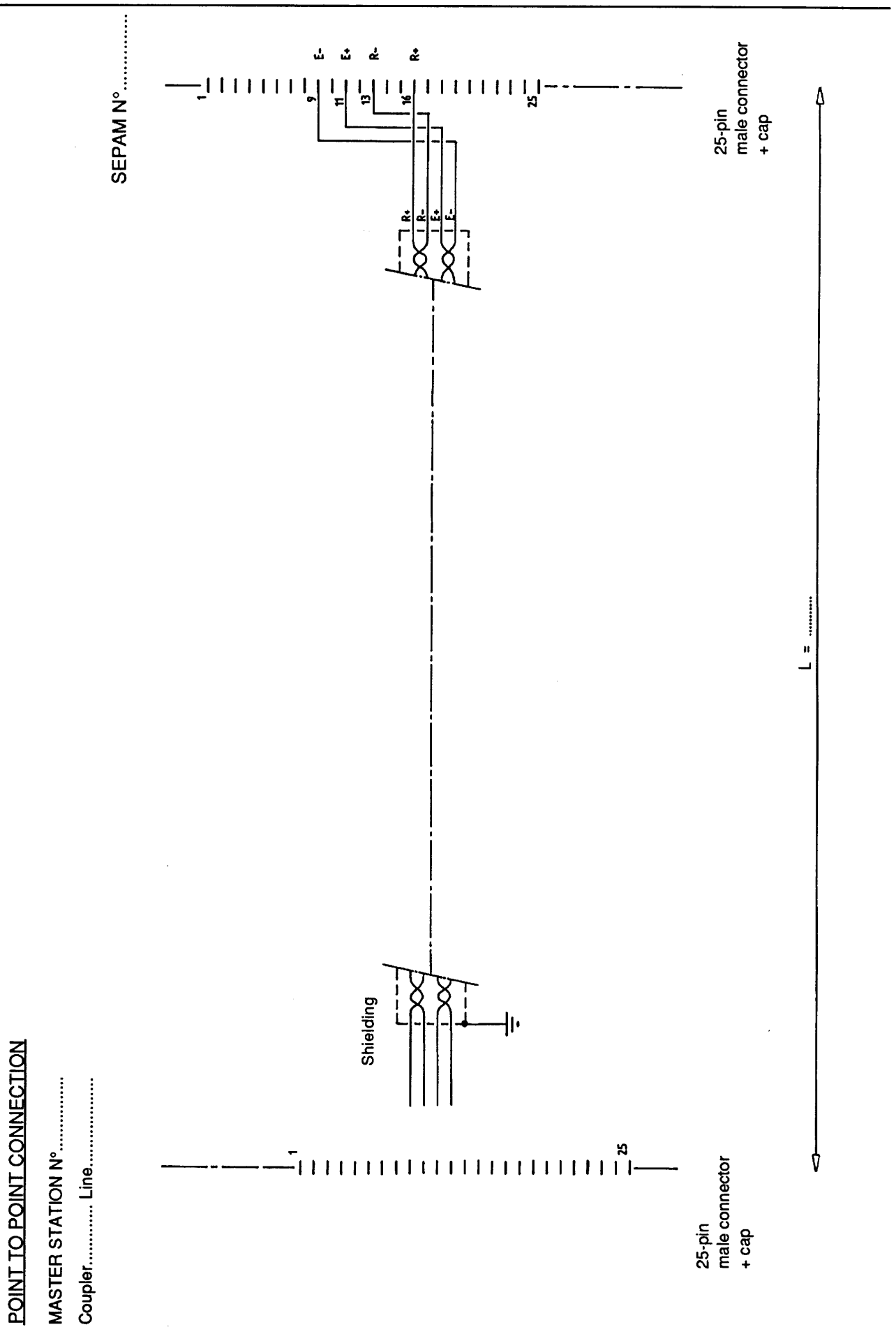
hexa address	wording MSB LSB 15 . . . . . 8/7 0	format	unit	word access	bit access
0700	timer set point T1	binary	10 ms	L	
0701	timer set point T2	binary	10 ms	L	
0702	timer set point T3	binary	10 ms	L	
0703	timer set point T4	binary	10 ms	L	
0704	timer set point T5	binary	10 ms	L	
0705	timer set point T6	binary	10 ms	L	
0706	timer set point T7	binary	10 ms	L	
0707	timer set point T8	binary	10 ms	L	
0708	timer set point T9	binary	10 ms	L	
0709	timer set point T10	binary	10 ms	L	
070A	timer set point T11	binary	10 ms	L	
070B	timer set point T12	binary	10 ms	L	
070C	timer set point T13	binary	10 ms	L	
070D	timer set point T14	binary	10 ms	L	
070E	timer set point T15	binary	10 ms	L	
070F	timer set point T16	binary	10 ms	L	
0710	counter status C1	bcd		L	
0711	counter status C2	bcd		L	
0712	counter status C3	bcd		L	
0713	counter status C4	bcd		L	
0714	counter status C5	bcd		L	
0715	counter status C6	bcd		L	
0716	counter status C7	bcd		L	
0717	counter status C8	bcd		L	
0718					
|					
|					
|					
07FF					

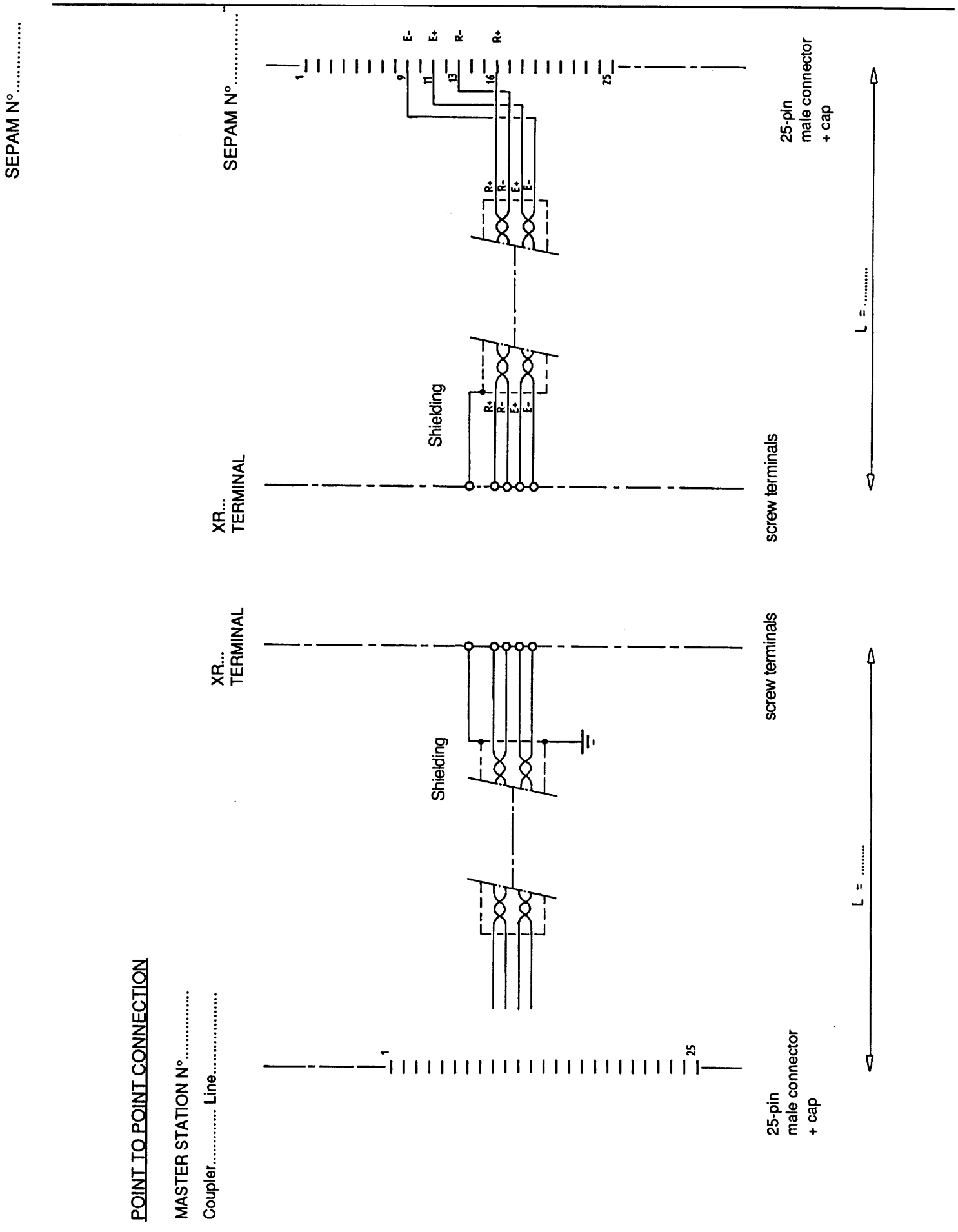
appendix 1

wiring layout form

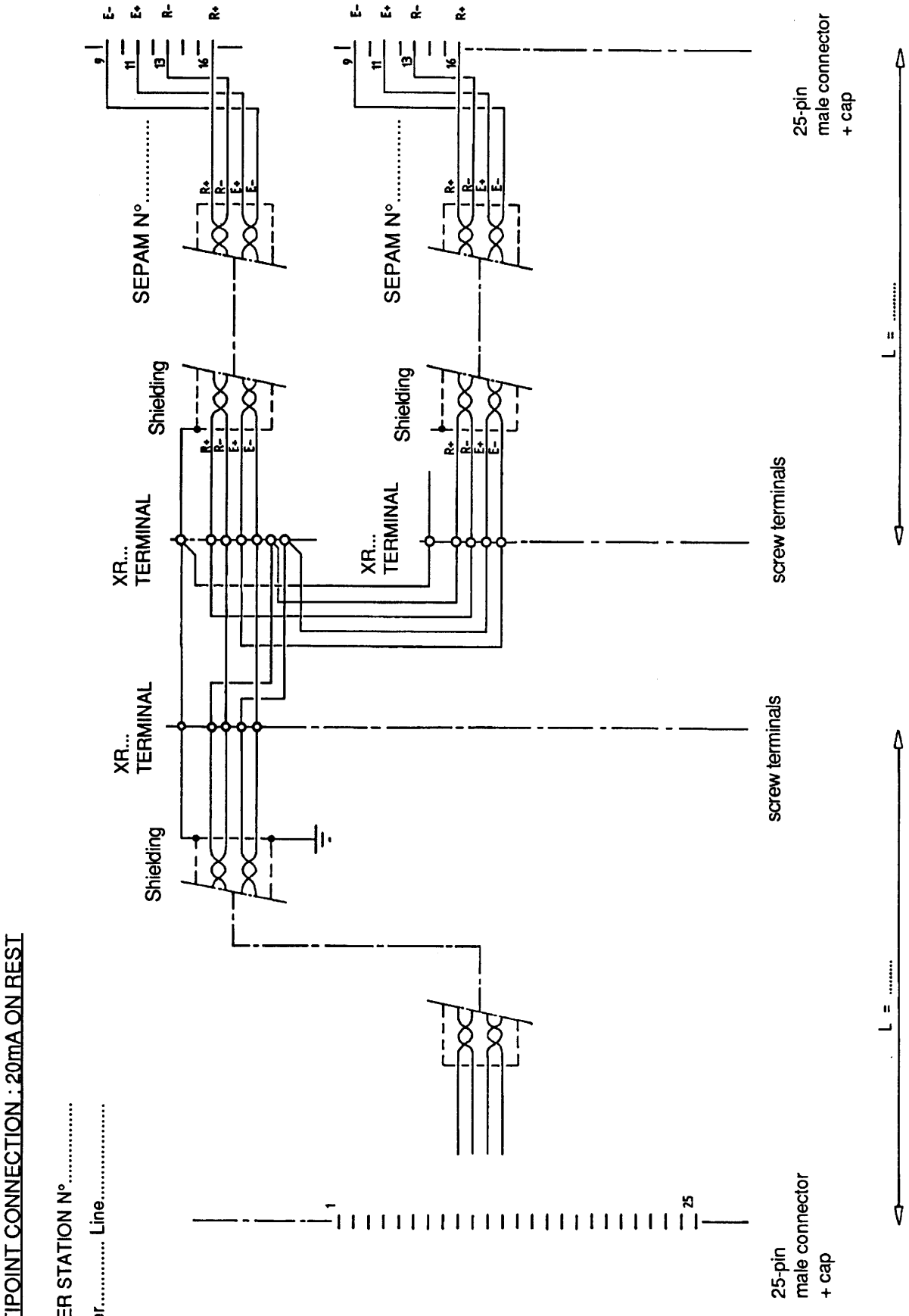
This form can be duplicated ; fill out one form per Sepam including:
- Sepam number,
- number of pins to be connected on master station side,
- intermediate terminal block with multipoint connection.

appendix 1

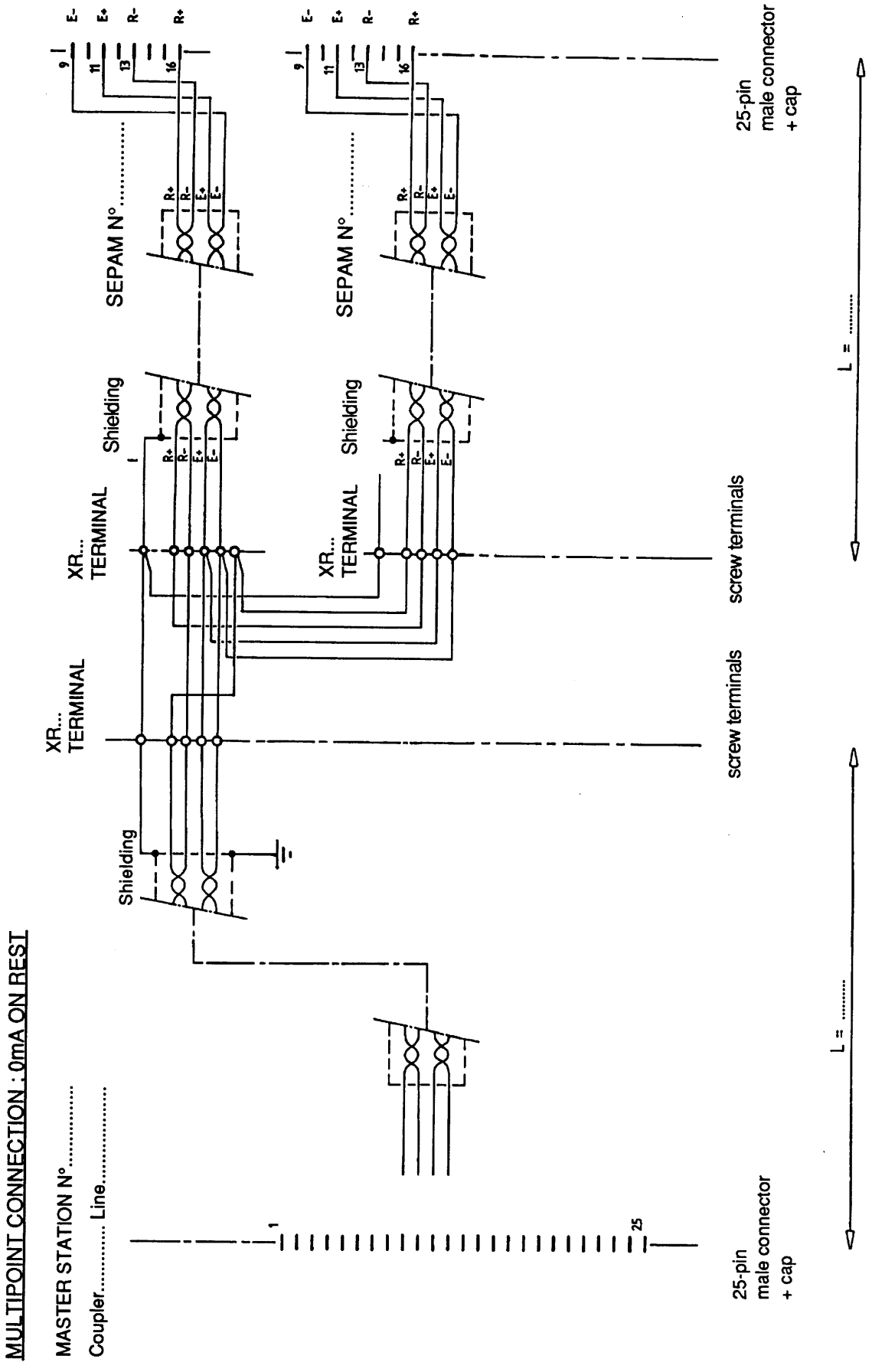

POINT TO POINT CONNECTION
MASTER STATION N°.....
Coupler..... Line.....
SEPAM N°.....
1
9
11
13
15
25
E-
E+
R-
R+
25-pin
male connector
+ cap
Shielding
L = ...


POINT TO POINT CONNECTION
MASTER STATION N°.....
Coupler..... Line.....
SEPAM N°.....
SEPAM N°.....
XR...
TERMINAL
XR...
TERMINAL
Shielding
Shielding
screw terminals
screw terminals
25-pin
male connector
+ cap
25-pin
male connector
+ cap
L = ...
L = ...
1
25
9
11
13
16
E-
E+
R-
R+

appendix 1


MULTIPOINT CONNECTION : 20mA ON REST
MASTER STATION N°.....
Coupler....., Line.....
SEPAM N°.....
SEPAM N°.....
XR... TERMINAL
XR... TERMINAL
Shielding
Shielding
Shielding
screw terminals
screw terminals
25-pin male connector + cap
25-pin male connector + cap
L = ...
L = ...
E-
E+
R-
R+
9
11
13
15
1
25

appendix 1


MULTIPOINT CONNECTION : 0mA ON REST
MASTER STATION N°.....
Coupler..... Line.....
SEPAM N°.....
SEPAM N°.....
XR...
TERMINAL
XR...
TERMINAL
XR...
TERMINAL
Shielding
Shielding
Shielding
E-
E+
R-
R+
9
11
13
16
1
25
screw terminals
screw terminals
25-pin
male connector
+ cap
25-pin
male connector
+ cap
L = ...
L = ...

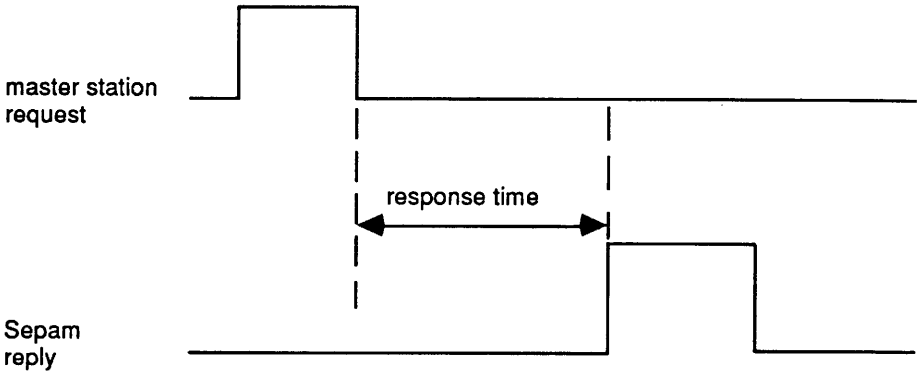
appendix 2

J BUS access time

The response time for Sepam serial transmission is measured using a single Sepam having **a cycle time of 30ms**, and with J BUS chronology and protocol in operation.

Teletransmission speed is 4800 bauds.

The time is measured between the **end** of the master station request and the **start** of the Sepam reply.



example 1: measurement of request time at 4800 bauds.
Sepam cycle time is 30 ms.

type of request	**time between the end of the master station request and the start of the Sepam reply**	
	typical	**max**
rapid reading of 8 bits (binary output)	25 ms	35ms
reading of a word (automation)	30ms	35ms
reading of all measurements	350 ms	400 ms
writing of a word (automation)	30 ms	35 ms
reading of a current I1	350 ms	400 ms
writing of a bit (automation)	50 ms	60 ms
request timedater table preparation	10 ms	10 ms
reading of timedater table (35 words)	30 ms	30 ms

example 2: measurement of request time (in ms) for the reading of a word (automation).

Sepam cycle time	transmission speed								
	300 bauds			1200 bauds			4800 bauds		
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.
11 ms	110	116	122	30	35	41	10	15	22
17 ms	110	118	127	30	39	47	10	19	28
21 ms	110	120	132	30	32	53	10	22	31
24 ms	110	123	134	30	46	57			
27 ms	110	125	138	30			11	24	38
32 ms	110			30	45	62			
35 ms	110	125	144	30					
47 ms	110			30			32	56	79

appendix 3

computing J BUS CRC 16

principle

■ the message is considered as a series of bits, arranged in the precise order in which they will be transmitted. This series of bits is identified with a polynomial of which the coefficient having the highest degree is the first bit to be transmitted.

example: message 02_H 07_H →

binary series: 0000 0111 0000 0010 (the first bit to be transmitted is the one on the right)

associated polynomial:

$M(x) = x^5 + x^6 + x^7 + x^{14}$

■ to differenciate messages starting with zero bytes, FF FF bytes are added to the first two bytes.

new series: 1111 1000 1111 1101

$M1(x) = 1 + x + x^2 + x^3 + x^4 + x^8 + x^9 + x^{10} + x^{11} + x^{12} + x^{13} + x^{15}$

■ this polynomial is then multiplied by x^{16} (the 16 LSB bits, thus initialized at 0, make up the CRC):

$M2(x) = x^{16} + x^{17} + x^{18} + x^{19} + x^{20} + x^{24} + x^{25} + x^{26} + x^{27} + x^{28} + x^{29} + x^{31}$

■ this polynomial is then divided by the generating polynomial:

$G(X) = 1 + x^2 + x^{15} + x^{16}$

■ the rest of the division, 15th degree at the most, makes up the CRC, in this case: $CRC(x) = x^3 + x^6 + x^9 + x^{15}$

■ the procedure actually sent is therefore $[x^{16} M(x)] + CRC(x)$

i.e. in this case:

$T(x) = x^3 + x^6 + x^9 + x^{15} + x^{21} + x^{22} + x^{23} + x^{30}$

series :

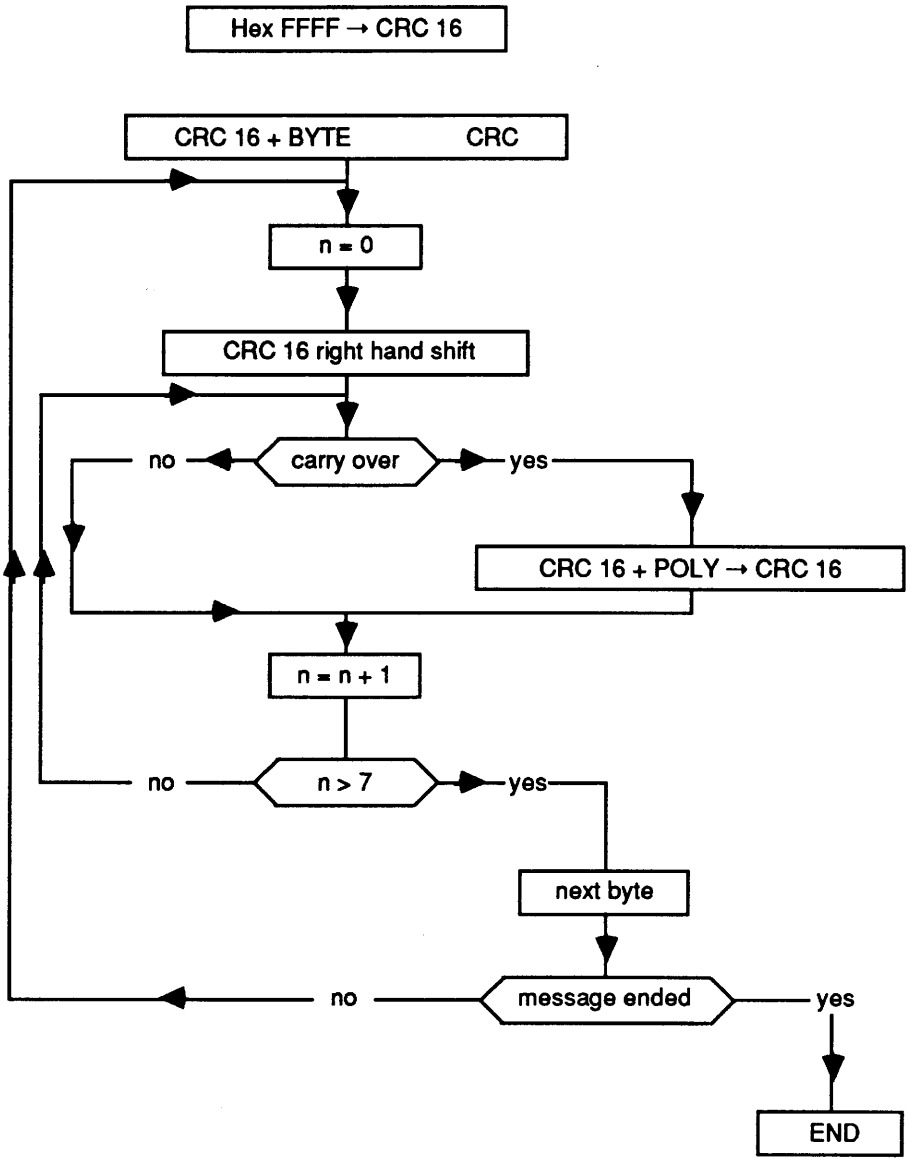
0001 0010 0100 0001 0000 0111 0000 0010

12_H 41_H 07_H 02_H

procedure (1st byte on the left):

02_H 07_H 41_H 12_H

appendix 3



+ = only or
n = number of bits of information
POLY = CRC 16 computing polynomial
$= 1 + X^2 + X^{15}$
the 1st byte of the CRC 16 sent out is
the one with the LSB.

appendix 3

Computing the CRC 16 using the table method

Program written in PASCAL

```
FUNCTION CRC 16 (VAR MESSAGE :
LSTRING) : WORD;

VAR I, J, LENGTH : INTEGER;
(* I auxiliary loop variable).
(* J auxiliary computing and movement
variable *).
(*LENGTH contains the number of
bytes which make up the message).

CH, CL : BYTE;
BEGIN
CH := 16#FF;
CL := 16#FF;
I := 1;
LENGTH := ORD (MESSAGE.
LEN) - 2;
WHILE (I < = LENGTH) 00
BEGIN
(* calculate research index n°*)
J := ORD (WRD (MESSAGE [I]) XOR
WRD (CH) ) + 1;
CH := TPF [J] XOR CL; (* calculate
MSB byte *)
CL := TPL [J]; (* calculate LSB byte *)
I := I + 1;
END;          (* end while *)
CRC 16 := WRD (CH * 256 + CL);
END;          (* end crc 16 *)
```

```
(* ALLOCATION OF LSB BYTE TABLE*)
TPL[1]   := 0;   TPL[2]   := 192; TPL[3]   := 193; TPL[4]   := 1;
TPL[5]   := 195; TPL[6]   := 3;   TPL[7]   := 2;   TPL[8]   := 194;
TPL[9]   := 198; TPL[10]  := 6;   TPL[11]  := 7;   TPL[12]  := 199;
TPL[13]  := 5;   TPL[14]  := 197; TPL[15]  := 196; TPL[16]  := 4;
TPL[17]  := 204; TPL[18]  := 12;  TPL[19]  := 13;  TPL[20]  := 205;
TPL[21]  := 15;  TPL[22]  := 207; TPL[23]  := 206; TPL[24]  := 14;
TPL[25]  := 10;  TPL[26]  := 202; TPL[27]  := 203; TPL[28]  := 11;
TPL[29]  := 201; TPL[30]  := 9;   TPL[31]  := 8;   TPL[32]  := 200;
TPL[33]  := 216; TPL[34]  := 24;  TPL[35]  := 25;  TPL[36]  := 217;
TPL[37]  := 27;  TPL[38]  := 219; TPL[39]  := 218; TPL[40]  := 26;
TPL[41]  := 30;  TPL[42]  := 222; TPL[43]  := 223; TPL[44]  := 31;
TPL[45]  := 221; TPL[46]  := 29;  TPL[47]  := 28;  TPL[48]  := 220;
TPL[49]  := 20;  TPL[50]  := 212; TPL[51]  := 213; TPL[52]  := 21;
TPL[53]  := 215; TPL[54]  := 23;  TPL[55]  := 22;  TPL[56]  := 214;
TPL[57]  := 210; TPL[58]  := 18;  TPL[59]  := 19;  TPL[60]  := 211;
TPL[61]  := 17;  TPL[62]  := 209; TPL[63]  := 208; TPL[64]  := 16;
TPL[65]  := 240; TPL[66]  := 48;  TPL[67]  := 49;  TPL[68]  := 241;
TPL[69]  := 51;  TPL[70]  := 243; TPL[71]  := 242; TPL[72]  := 50;
TPL[73]  := 54;  TPL[74]  := 246; TPL[75]  := 247; TPL[76]  := 55;
TPL[77]  := 245; TPL[78]  := 53;  TPL[79]  := 52;  TPL[80]  := 244;
TPL[81]  := 60;  TPL[82]  := 252; TPL[83]  := 253; TPL[84]  := 61;
TPL[85]  := 255; TPL[86]  := 63;  TPL[87]  := 62;  TPL[88]  := 254;
TPL[89]  := 250; TPL[90]  := 58;  TPL[91]  := 59;  TPL[92]  := 251;
TPL[93]  := 57;  TPL[94]  := 249; TPL[95]  := 248; TPL[96]  := 56;
TPL[97]  := 40;  TPL[98]  := 232; TPL[99]  := 233; TPL[100] := 41;
TPL[101] := 235; TPL[102] := 43;  TPL[103] := 42;  TPL[104] := 234;
TPL[105] := 238; TPL[106] := 46;  TPL[107] := 47;  TPL[108] := 239;
TPL[109] := 45;  TPL[110] := 237; TPL[111] := 236; TPL[112] := 44;
TPL[113] := 228; TPL[114] := 36;  TPL[115] := 37;  TPL[116] := 229;
TPL[117] := 39;  TPL[118] := 231; TPL[119] := 230; TPL[120] := 38;
TPL[121] := 34;  TPL[122] := 226; TPL[123] := 227; TPL[124] := 35;
TPL[125] := 225; TPL[126] := 33;  TPL[127] := 32;  TPL[128] := 224;
TPL[129] := 160; TPL[130] := 96;  TPL[131] := 97;  TPL[132] := 161;
TPL[133] := 99;  TPL[134] := 163; TPL[135] := 162; TPL[136] := 98;
TPL[137] := 102; TPL[138] := 166; TPL[139] := 167; TPL[140] := 103;
TPL[141] := 165; TPL[142] := 101; TPL[143] := 100; TPL[144] := 164;
TPL[145] := 108; TPL[146] := 172; TPL[147] := 173; TPL[148] := 109;
TPL[149] := 175; TPL[150] := 111; TPL[151] := 110; TPL[152] := 174;
TPL[153] := 170; TPL[154] := 106; TPL[155] := 107; TPL[156] := 171;
TPL[157] := 105; TPL[158] := 169; TPL[159] := 168; TPL[160] := 104;
TPL[161] := 120; TPL[162] := 184; TPL[163] := 185; TPL[164] := 121;
TPL[165] := 187; TPL[166] := 123; TPL[167] := 122; TPL[168] := 186;
TPL[169] := 190; TPL[170] := 126; TPL[171] := 127; TPL[172] := 191;
TPL[173] := 125; TPL[174] := 189; TPL[175] := 188; TPL[176] := 124;
TPL[177] := 180; TPL[178] := 116; TPL[179] := 117; TPL[180] := 181;
TPL[181] := 119; TPL[182] := 183; TPL[183] := 182; TPL[184] := 118;
TPL[185] := 114; TPL[186] := 178; TPL[187] := 179; TPL[188] := 115;
TPL[189] := 177; TPL[190] := 113; TPL[191] := 112; TPL[192] := 176;
TPL[193] := 80;  TPL[194] := 144; TPL[195] := 145; TPL[196] := 81;
TPL[197] := 147; TPL[198] := 83;  TPL[199] := 82;  TPL[200] := 146;
TPL[201] := 150; TPL[202] := 86;  TPL[203] := 87;  TPL[204] := 151;
TPL[205] := 85;  TPL[206] := 149; TPL[207] := 148; TPL[208] := 84;
TPL[209] := 156; TPL[210] := 92;  TPL[211] := 93;  TPL[212] := 157;
TPL[213] := 95;  TPL[214] := 159; TPL[215] := 158; TPL[216] := 94;
TPL[217] := 90;  TPL[218] := 154; TPL[219] := 155; TPL[220] := 91;
TPL[221] := 153; TPL[222] := 89;  TPL[223] := 88;  TPL[224] := 152;
TPL[225] := 136; TPL[226] := 72;  TPL[227] := 73;  TPL[228] := 137;
TPL[229] := 75;  TPL[230] := 139; TPL[231] := 138; TPL[232] := 74;
TPL[233] := 78;  TPL[234] := 142; TPL[235] := 143; TPL[236] := 79;
TPL[237] := 141; TPL[238] := 77;  TPL[239] := 76;  TPL[240] := 140;
TPL[241] := 68;  TPL[242] := 132; TPL[243] := 133; TPL[244] := 69;
TPL[245] := 135; TPL[246] := 71;  TPL[247] := 70;  TPL[248] := 134;
TPL[249] := 130; TPL[250] := 66;  TPL[251] := 67;  TPL[252] := 131;
TPL[253] := 65;  TPL[254] := 129; TPL[255] := 128; TPL[256] := 64;
```

appendix 3

```
(* ALLOCATION OF MSB  BYTE TABLE *)
TPF[1]   := 0;   TPF[2]   := 193; TPF[3]   := 129; TPF[4]   := 64;
TPF[5]   := 1;   TPF[6]   := 192; TPF[7]   := 128; TPF[8]   := 65;
TPF[9]   := 1;   TPF[10]  := 192; TPF[11]  := 128; TPF[12]  := 65;
TPF[13]  := 0;   TPF[14]  := 193; TPF[15]  := 129; TPF[16]  := 64;
TPF[17]  := 1;   TPF[18]  := 192; TPF19]   := 128; TPF[20]  := 65;
TPF[21]  := 0;   TPF[22]  := 193; TPF[23]  := 129; TPF[24]  := 64;
TPF[25]  := 0;   TPF[26]  := 193; TPF[27]  := 129; TPF[28]  := 64;
TPF29]   := 1;   TPF[30]  := 192; TPF[31]  := 128; TPF[32]  := 65;
TPF[33]  := 1;   TPF[34]  := 192; TPF[35]  := 128; TPF[36]  := 65;
TPF[37]  := 0;   TPF[38]  := 193; TPF[39]  := 129; TPF[40]  := 64;
TPF[41]  := 0;   TPF[42]  := 193; TPF[43]  := 129; TPF[44]  := 64;
TPF[45]  := 1;   TPF[46]  := 192; TPF[47]  := 128; TPF[48]  := 65;
TPF[49]  := 0;   TPF[50]  := 193; TPF[51]  := 129; TPF[52]  := 64;
TPF[53]  := 1;   TPF[54]  := 192; TPF[55]  := 128; TPF56]  := 65;
TPF[57]  := 1;   TPF[58]  := 192; TPF[59]  := 128; TPF[60]  := 65;
TPF[61]  := 0;   TPF[62]  := 193; TPF[63]  := 129; TPF[64]  := 64;
TPF[65]  := 1;   TPF[66]  := 192; TPF[67]  := 128; TPF[68]  := 65;
TPF[69]  := 0;   TPF[70]  := 193; TPF[71]  := 129; TPF[72]  := 64;
TPF[73]  := 0;   TPF[74]  := 193; TPF[75]  := 129; TPF[76]  := 64;
TPF[77]  := 1;   TPF[78]  := 192; TPF[79]  := 128; TPF[80]  := 65;
TPF[81]  := 0;   TPF[82]  := 193; TPF[83]  := 129; TPF[84]  := 64;
TPF[85]  := 1;   TPF[86]  := 192; TPF[87]  := 128; TPF[88]  := 65;
TPF[89]  := 1;   TPF[90]  := 192; TPF[91]  := 128; TPF[92]  := 65;
TPF[93]  := 0;   TPF[94]  := 193; TPF[95]  := 129; TPF[96]  := 64;
TPF[97]  := 0;   TPF[98]  := 193; TPF[99]  := 129; TPF[100] := 64;
TPF[101] := 1;   TPF[102] := 192; TPF[103] := 128; TPF[104] := 65;
TPF[105] := 1;   TPF[106] := 192; TPF[107] := 128; TPF[108] := 65;
TPF[109] := 0;   TPF[110] := 193; TPF[111] := 129; TPF[112] := 64;
TPF[113] := 1;   TPF[114] := 192; TPF[115] := 128; TPF[116] := 65;
TPF[117] := 0;   TPF[118] := 193; TPF[119] := 129; TPF[120] := 64;
TPF[121] := 0;   TPF[122] := 193; TPF[123] := 129; TPF[124] := 64;
TPF[125] := 1;   TPF[126] := 192; TPF[127] := 128; TPF[128] := 65;
TPF[129] := 1;   TPF[130] := 192; TPF[131] := 128; TPF[132] := 65;
TPF[133] := 0;   TPF[134] := 193; TPF[135] := 129; TPF[136] := 64;
TPF[137] := 0;   TPF[138] := 193; TPF[139] := 129; TPF[140] := 64;
TPF[141] := 1;   TPF[142] := 192; TPF[143] := 128; TPF[144] := 65;
TPF[145] := 0;   TPF[146] := 193; TPF[147] := 129; TPF[148] := 64;
TPF[149] := 1;   TPF[150] := 192; TPF[151] := 128; TPF[152] := 65;
TPF[153] := 1;   TPF[154] := 192; TPF[155] := 128; TPF[156] := 65;
TPF[157] := 0;   TPF[158] := 193; TPF[159] := 129; TPF[160] := 64;
TPF[161] := 0;   TPF[162] := 193; TPF[163] := 129; TPF[164] := 64;
TPF[165] := 1;   TPF[166] := 192; TPF[167] := 128; TPF[168] := 65;
TPF[169] := 1;   TPF[170] := 192; TPF[171] := 128; TPF[172] := 65;
TPF[173] := 0;   TPF[174] := 193; TPF[175] := 129; TPF[176] := 64;
TPF[177] := 1;   TPF[178] := 192; TPF[179] := 128; TPF[180] := 65;
TPF[181] := 0;   TPF[182] := 193; TPF[183] := 129; TPF[184] := 64;
TPF[185] := 0;   TPF[186] := 193; TPF[187] := 129; TPF[188] := 64;
TPF[189] := 1;   TPF[190] := 192; TPF[191] := 128; TPF[192] := 65;
TPF[193] := 0;   TPF[194] := 193; TPF[195] := 129; TPF[196] := 64;
TPF[197] := 1;   TPF[198] := 192; TPF[199] := 128; TPF[200] := 65;
TPF[201] := 1;   TPF[202] := 192; TPF[203] := 128; TPF[204] := 65;
TPF[205] := 0;   TPF[206] := 193; TPF[207] := 129; TPF[208] := 64;
TPF[209] := 1;   TPF[210] := 192; TPF[211] := 128; TPF[212] := 65;
TPF[213] := 0;   TPF[214] := 193; TPF[215] := 129; TPF[216] := 64;
TPF[217] := 0;   TPF[218] := 193; TPF[219] := 129; TPF[220] := 64;
TPF[221] := 1;   TPF[222] := 192; TPF[223] := 128; TPF[224] := 65;
TPF[225] := 1;   TPF[226] := 192; TPF[227] := 128; TPF[228] := 65;
TPF[229] := 0;   TPF[230] := 193; TPF[231] := 129; TPF[232] := 64;
TPF[233] := 0;   TPF[234] := 193; TPF[235] := 129; TPF[236] := 64;
TPF[237] := 1;   TPF[238] := 192; TPF[239] := 128; TPF[240] := 65;
TPF[241] := 0;   TPF[242] := 193; TPF[243] := 129; TPF[244] := 64;
TPF[245] := 1;   TPF[246] := 192; TPF[247] := 128; TPF[248] := 65;
TPF[249] := 1;   TPF[250] := 192; TPF[251] := 128; TPF[252] := 65;
TPF[253] := 0;   TPF[254] := 193; TPF[255] := 129; TPF[256] := 64;
```

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télex: merge 320 842 F

As our equipment is constantly evolving. certain discrepancies may arise between the equipment received and the present document, for which we apalogize.

3120145A-D

Designed and written by Merlin Gerin
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