EUR 5142 e

COMMISSION OF THE EUROPEAN COMMUNITIES

SMART DATA STATION

by

E. BETTENDROFFER and F. SOREL

1974

Joint Nuclear Research Centre
Ispra Establishement - Italy

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Luxembourg, September 1974 - 40 Pages - 19 Figures - B.Fr. 60,—

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— data acquisition and control of the experiments instrumentation (e.g. temperature, pressure);

— storage and transmission to the minicomputer of data introduced by a keyboard (e.g. selecting of programs).

Since the terminal includes a transmission system, the instrumentation of the experiment can be distantly located from the computer.

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ABSTRACT

The features of the terminal SMART allow an effective dialogue between the experimentalist, the data sources of the experiment and the computer.

The terminal performs mainly two functions :

— data acquisition and control of the experiments instrumentation (e.g. temperature, pressure);

— storage and transmission to the minicomputer of data introduced by a keyboard (e.g. selecting of programs).

Since the terminal includes a transmission system, the instrumentation of the experiment can be distantly located from the computer.

CONTENTS

ACKNOWLEDGEMENT

The design and realization of the mechanical part of the terminal was achieved by M. Jünger.

1) INTRODUCTION

Automation of experiments by a small computer implies effective communication facilities between the experimentalist, the data sources and the computer. Data from the instrumentation of the experiments (e.g. temperature, pressure, and so on) have to be communicated to the computer, but also a certain dialogue between the experimentalist and the computer (e.g. selecting of programs, sending data by means of a keyboard) is required.

Another important feature is the possibility to connect several distantly located instrumentations to the computer.

To fulfill these general requirements the SMART station (SMART = System for Measurement and Automation in Real Time) has been developed. The realized SMART stations are operating with the mini-computer General Automation SPC-16 under a disc-based operating system. The number of stations to be operated in parallel is limited mainly by the available memory size; the operation is virtually simultaneous with other programs.

The general configuration consists in the instrumentation and the station on the experiment site, a multiwire cable and a controller board on the computer site (see fig. 1). This configuration is repeated for each station. The existing instrumentation includes a digital voltmeter, a scanner and a scanner controller.
Actually three SMART stations are connected to the computer.

2) BLOCK DIAGRAM

The block diagram of the SMART station and the control unit B in the computer is shown in fig. 2.
According to the operation mode selected by the operator, the station performs mainly two functions :

- data acquisition and control of the experiments instrumentation : source mode ;
- transmission of data introduced by a keyboard : manual mode.

2.1. Data flow

The data originating from the experiments instrumentation, consisting in a digital integrating voltmeter, are routed through level adapters to the multiplexer (see fig. 2). The digital voltmeter presents its data in parallel, six digits for the value, one digit for the exponent and one digit for the function (+DC, -DC, Ohm), totally eight digits.

The data originating from the keyboard are decoded and stored in the latches.
The content of the buffer is of eight digits ; the first represents the function (Mode source or manual), the second the exponent and the following six the value. The outputs of the latches are connected to the multiplexer.

The multiplexer switches the data from the voltmeter or the data from the keyboard to the line drivers according to the operation mode selected by the station operator.

The output of the multiplexer presents the whole data block of eight digits in four successive groups of two digits (eight bit) each. The data transfer between station and computer is of eight bit in parallel, which represents in this case a compromise between data transfer rate and capacity of the multiwire cable.

The differential line drivers transmit the data on a multiwire cable consisting of twisted pairs to the line receivers in the controller board SMART (control unit B) on the computer site. The maximal transmission distance depends upon the characteristics of the cable and amounts to several kilometers. The data are gated from the line receivers of the controller board to the data input bus of the computer.

2.2. Control signals

The dialogue between the instrumentation and the station is the following :

each time the measured value is ready on the output of the voltmeter, a signal "record command" is given to the station. The station communicates to the computer by means of an interrupt signal that data are ready. After a certain signal exchange between station and computer (see chapter 3) the computer loads the data block. At the end of the transmission of a data block the station generates a signal "channel advance" which causes the scanner to switch to the next position. The voltmeter converts the data corresponding to the new position and the cycle is repeated until the upper limit of the scanner, selected by the operator, is reached.

The keyboard control allows the operator to write serially the information from the keyboard in the latches, the content of which is displayed. In case of erroneous key-input, a correction possibility is given by the key labeled "back" which cancels the last written character. Values in floating point are introduced by the negative exponent of the whole value. The exponent is displayed as decimal point.
If the information in the keyboard buffer is ready, the operator activates the key "send" for transmitting the buffer content to the computer. In a similar way to the operation mode of the digital source, the station generates an interrupt to the computer which successively loads the data. At the end of the transmission the keyboard buffer is automatically cleared. Thus, the operator can check on the display if the computer has accepted the data block.

The multiplexer control selects the right multiplexer address considering the selected operation mode and the sequence of the four data groups of two digits each to be transmitted to the computer.

An interlock circuit inhibits the line receivers in the station and on the controller board in case the power on the experiment site or on the computer site is off.
Furthermore in order to avoid erroneous data transmission when switching on or off the power of the station, the interlock circuit enables the receivers on both sides only after the first interrupt generation and inhibits after the station has been cleared.

3) SIGNAL EXCHANGE BETWEEN STATION AND COMPUTER

The signal exchange between station and computer is achieved according to the handshake-mode : each generated signal on either side remains on until reception of the corresponding acknowledgement signal. This dialogue is automatically adapted to any delay introduced by the transmission over the cable. The station is connected over a cable to the SMART controller board (control unit B) which has access to the input/output system of the computer.

Therefore the control unit B handles as well signals to and from the distantly located station as signals to and from the computer. In the fig. 3 "Timing station-computer" are shown in the upper part the signals handled by the station, in the middle part the delay introduced by the cable and in the lower part the signals handled by the control unit B.

When the station is ready to transfer data to the computer, the station turns on the signal interrupt (INT). This signal is received in the control unit B after the delay on the cable and activates two signals towards the computer :

-"external interrupt signal" (EIR) which is common to all attached SMART stations

-"device test function" (DTFA) which allows the computer to address the requesting station.

After the computer has accepted the interrupt signal and the program control is switched to the SMART routine, the signal "device control pulse" (DCP) is sent from the computer to the requesting control unit B.
This pulse of short duration is transformed by the control unit B in the signal "function" (FUN) which is sent to the station. This signal communicates to the operator and to the station that the computer has accepted the interrupt request and is ready to load the data from the station.
Upon reception of the signal FUN the station turns off the signal INT and enables the line drivers for the data transmission by the signal DST. After the cable delay, the negative transient of INT switches off the signal FUN and the dialogue between the two signals INT and FUN is ultimated.

The station communicates to the control unit B that the first group of data is set on the cable by the signal "read command" (REC). The control unit B indicates to the computer by activating the test line (DTFB) that the data are ready on the input bus of the computer. The computer loads the data by generating the pulse "data transfer input function" (DTIF) from which the control unit B derives the signal "data transfer" (DAT) sent to the station. This signal says to the station that the first data group has been accepted by the computer ; the station sets the second data group on the line and activates again the "read command" (REC). The cycle described before is repeated three times until the four data groups have been loaded by the computer.

The fourth and last"data transfer" (DAT) causes in the station in source mode a channel advance of the scanner or in manual mode a clearing of the keyboard buffer.

4) CIRCUIT DESCRIPTION

4.1. Level adapters (see fig. 4)

The level adapters consisting of differential line receivers (SN 75107) on two cards convert the logical output levels of the digital voltmeter to the required input levels of the multiplexers.

output levels of voltmeter : logical 1 : -2.5 ÷ 0V
logical 0 : - 35 ÷ - 24 V

output impedance of voltmeter : data lines : 100 kOhm
control " : 33 kOhm

input levels of multiplexer : logical 1 : + 2.4 ÷ + 5 V
logical 0 : 0 ÷ + 0.8 V

Because of the excessive output levels of the voltmeter applied to the differential input of the line receivers, an attenuation of 10 is provided by means of resistors. The threshold level between logical 1 and 0 is determined by a negative reference voltage of 1.4 V. A series resistor is inserted in each signal input of the receivers in order to avoid oscillation due to the cable capacity and high output impedance of the voltmeter.

4.2. Decoder (see fig. 5)

Since the numerical keyboard is formed by pushbuttons with two closing contacts each, a decoder with quad two input nand gates is used to give a BCD (1248) output to the latches. One contact of each pushbutton is used to generate the strobe signal COD.

4.3. Latches (see fig. 6)

The operator introduces the manual data character by character on its keyboard. A value contains six digits plus the negative exponent to indicate values in floating point. The exponent is written by the operator as the seventh character and is displayed as decimal point.

The latches store the seven digits of each value ; the outputs of the latches are routed to the display and to the multiplexers. The used circuits are four bit bistable latches SN 7475, the clocks of which are generated by the circuit "keyboard control".

4.4. Keyboard control (see figs. 7 and 8)

This circuit provides the correct address for the latches each time a character is introduced by the keyboard and the correction possibility in case of erroneous key input. The main part is a synchronous 8-bit parallel access left/right shift register (SN 74198) which activates one of the seven latch addresses.

The signal "reset latch" (REL) which is an or-function between the key "reset" of the station and the fourth signal DAT in manual mode involves a parallel load into the shift register

of the following configuration : A = 1, B, C, D, E, F, G, H, = 0.

It may be mentioned that a load operation requires a clock pulse given by the signal flow REL - TRI - OS 1 - CP. Simultaneously the signal REL inhibits the gates D 1 ÷ D4, E1 ÷ E3 which clocks all latches in order to write in 0 in the latches.

Since the left serial input is connected to 0, the logical 1 is shifted with each clock pulse of one position to right. Each actuation of a pushbutton of the numerical keyboard causes a clock pulse by the signal flow COD, TRI, OS 1. The negative transient of the one-shot OS 1 starts the one-shot OS 2 the output of which (STR) strobes the gate B 1 ÷ B 4, C 1 ÷ C 3. Therefore the latch address (CL) is given by the output of the shift register (logical 1) gated by STR. In the described operation mode the one-shot OS 1 generates the clock pulse CP and the one-shot OS 2 the strobe signal STR.

In case of erroneous key-input, the operator has the possibility with the key "back" to clear the latch of the last introduced character and to step backwards the shift to the precedent address.

In this operation mode the one-shot OS 1 generates the strobe signal STR and the one-shot OS 2 the clock pulse CP. The inversion of this signal sequence is actuated by the gates L1, L2, M1, L3, L4, M2. Repeated actuation of the "back" key causes a corresponding number of clearings and backward steps.

By operating the "back" key a different combination of the control lines S0, S1 is selected in order to invert the shift direction of the register. The contacts of all control keys as "back", "send", "request", "reset" are routed first to set-reset flip-flops in order to eliminate bouncing.

The card "keyboard control" includes the general reset circuit for the station controlled by the key "reset" or by the initial reset generated through a RC by turning on the power.

4.5. Multiplexers (see fig. 9)

The multiplexers route the data from the keyboard buffer (7 digits) or from the digital voltmeter (8 digits) to the line drivers of the cable (2 digits).

There are on two cards eight multiplexers SN 74151 each with eight inputs. On each multiplexer the inputs 0 to 3 are reserved to manual data, the inputs 4 to 7 to source data.

The multiplexer handling the digit "function" has the input 0 and 4 connected to the signal "source" which is logical 0 for manual mode and logical 1 for source mode. The inputs 1, 2, 3 are wired to 0 whereas the inputs 5, 6, 7 are connected to the three first function bits of the voltmeter.

The position of all multiplexers is controlled by the "select inputs" coming from the circuit multiplexer control.

The gates on the output lines allow to program in hardware a configuration of bits for the station identification with the multiplexers inhibited. This possibility is not used in the actual stations.

4.6. Multiplexer control (see figs. 10 and 11)

The multiplexer control circuit includes mainly :

- a counter with parallel load possibility (G) for selecting the position of the multiplexers
- a divide by four counters (A1, A2) for the sequence of the four data groups transmitted to the computer
- a logical part (B3, B4, C2) assigned to the selection of the operation mode (manual - source).

The "mode" key connected to a set - reset flip-flop (B3, B4) clocks a J - K flip-flop C2 wired in counter function. The general reset switches the flip-flop in manual mode. In manual mode the multiplexers have to be selected from 0 to 3 whereas in source mode from 4 to 7. Therefore, before the transmission of the four data groups, the counter G has to be cleared in manual mode, but has to be loaded to 4 in source mode. During the transmission the signal DAT clocks the "count up" input of the counter G which steps forward the multiplexers.

Since there are 4 data groups to be transmitted the counter (A1, A2) is clocked by the signal CP4 derived from the read command. The fourth CP4 turns on D which enables the J - K inputs of the flip-flop C1. This flip-flop, clocked by DAT, generates an enable signal (EN) in absence of transmission in order to clear or load the counter G.

4.7. Control unit A (see figs. 12 and 13)

The control unit A performs the required dialogue between the station and the control unit B.

There are three possibilities to generate the interrupt signal (INT) :

- key "request" to check the disponibility of the computer
- key "send" to transmit data from the keyboard buffer
- signal "record command" from digital voltmeter to transmit source data.

The corresponding circuits are situated in the upper part of fig. 12. It may be mentioned that the signal "request" sets only the flip-flops D1 and D2 whereas the signals "send" and "record command" set furthermore the flip-flop J1. This causes that the "request" signal generates only an interrupt signal, whereas the "send" and "record command" generate an interrupt and prepare the following transmission of a data block. The acknowledgement signal (FUN) from the computer resets the flip-flop D2 and sets J2 only in the case J1 has been set previously by the"send" or "record command". The output of J2 enables the line drivers through the signal DST and generates the signal REC gated by DAT and FUN. (See chapter 3 "signal exchange").

The control unit A activates also the signals CP4 and RC4 for the multiplexer control circuit.

The fourth DAT signal which means the end of the transmission of a data block resets the flip-flops J1, J2 and according to the operation mode causes a "channel advance (CHA) or a reset latches"(REL).

The three one-shots E1, E2, G stretch the pulses FUN, DAT, fourth DAT to drive the lights ON-LINE, TRANSMISSION and to adapt the signal channel advance to the requirements of the voltmeter. These one-shots are cleared by the flip-flop D1 until the first interrupt signal is given in order to assure an efficient initial reset if turning on the power of the station.

In the upper left part of the fig. 12, a circuit activates the light "source on" if the voltmeter is connected to the station and switched on.

4.8. Control unit B (see fig. 14)

The control unit B, consisting in a board inserted in the input/output box of the computer, is connected on one side to the transmission cable and on the other side to the interface level 2 of the input/output unit.

On the left part of fig. 14 the iifferential line drivers and receivers for the data and control signals are represented.

The data are routed from the line receivers to the gates P1 ÷ P4, R1 ÷ R4 enabled by the read strobe of the computer (DSF, DTIF) to the data input bus of the computer (DIOO ÷ 07). Because of the bus structure which allows an easy connection of other SMART stations, the collectors of the gates are open.

The detailed function of the different control signals is described in the chapter 3.

In the off-condition of the interrupt signal the flip-flop K1 (output : FUN) is cleared ; by switching on the interrupt the flip-flop is no more cleared and can be set by the pulse DCP. The light "WAIT" indicates to the computer operator the on-condition of the interrupt. This condition can be reset by a pushbutton in case of anomalous operation conditions ; the pushbutton simulates a DCP which turns on through the flip-flop K1 the signal FUN which resets on the station side the interrupt flip-flop.

The signal REC sets the flip-flop K2 which activates DTFB and the flip-flop is reset by DSF, DTIF or the pushbutton reset.

The off-condition of the signal REC or the pushbutton reset clears the flip-flop L1 (output : DAT) ; if REC goes on the flip-flop is no more cleared and can be set by the read strobe of the computer DSF, DTIF.

In the lower part of fig. 14 there is the interlock circuit consisting of two reed relays and an active RC delay.

This circuit enables the line receivers of the two control signals INT and REC if the distantly located station generates the signal INTERLOCK and if the power of the control unit B derived from the computer power is on. The delay circuit enables the receivers after the powers of the different units of the system reach the normal operation condition.

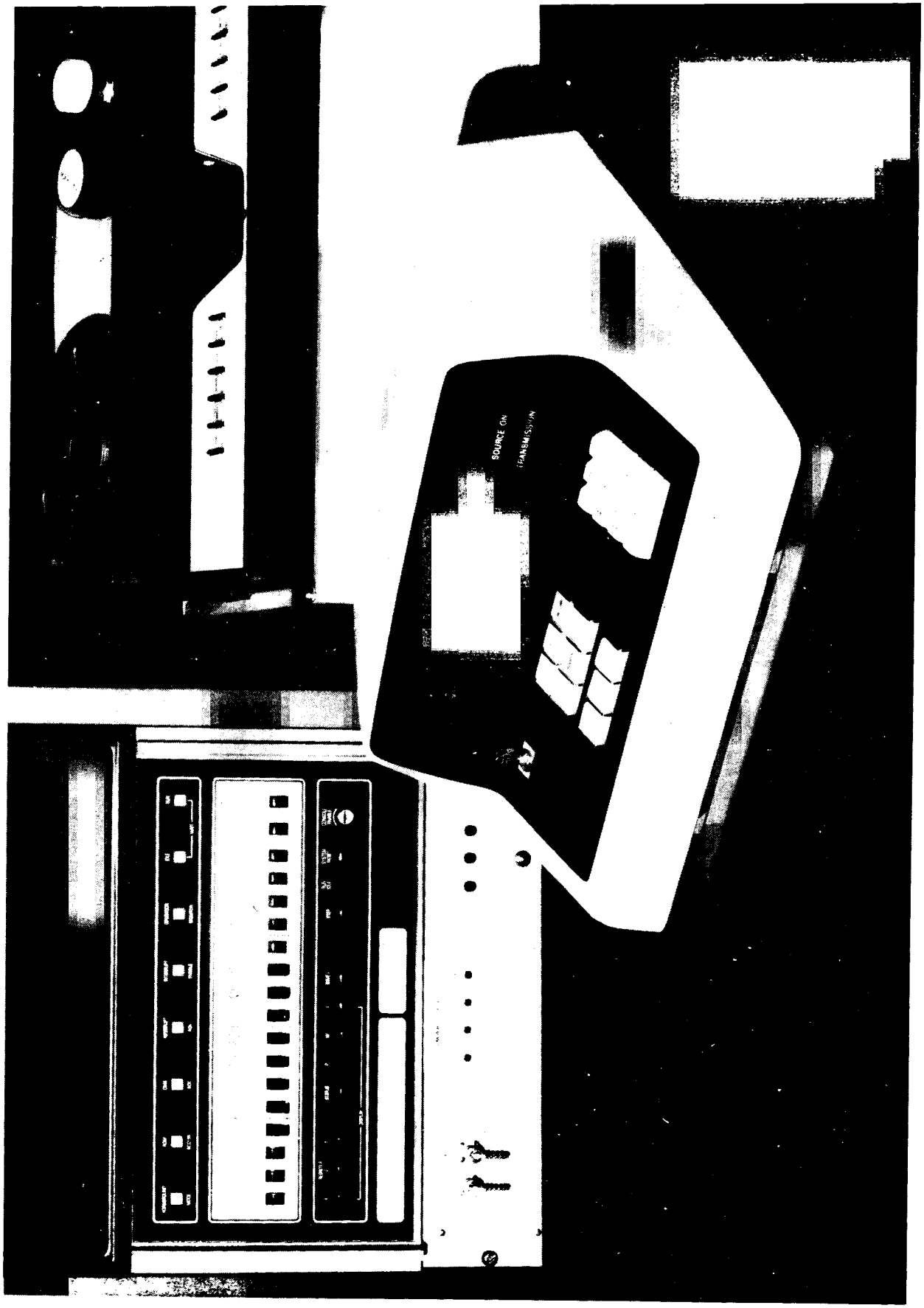
4.9. Interlock and power control (see figs. 15 and 16)

The interlock circuit on the station side enables the line receivers of the control signals DAT and FUN only if the power of the station and of the control unit B is on and after the station operator has activated the first time an interrupt. The circuit includes two reed relays ; one controlled by the power -15 V and the other by the output of the flip-flop D1 on the card "control unit A". These two relays generate the signal INTERLOCK to the two relays situated on the board "control unit B" on the computer side.

The power control, consisting of two comparators supervising the two powers + 5V and - 5V, inhibits the signal "channel advance" delivered to the voltmeter hardly one tension falls down of 10 % of the nominal value. This circuit avoids an erroneous "channel advance" when turning off the power of the station.

4.10 Display

The display circuit performing the multiplexing and the floating point is described in the internal report (not available) : "Affichage numérique de nombres en virgule flottante" by Combet, Termanini, Ispra 1972.


SOURCE ON
(TRANSMISSION

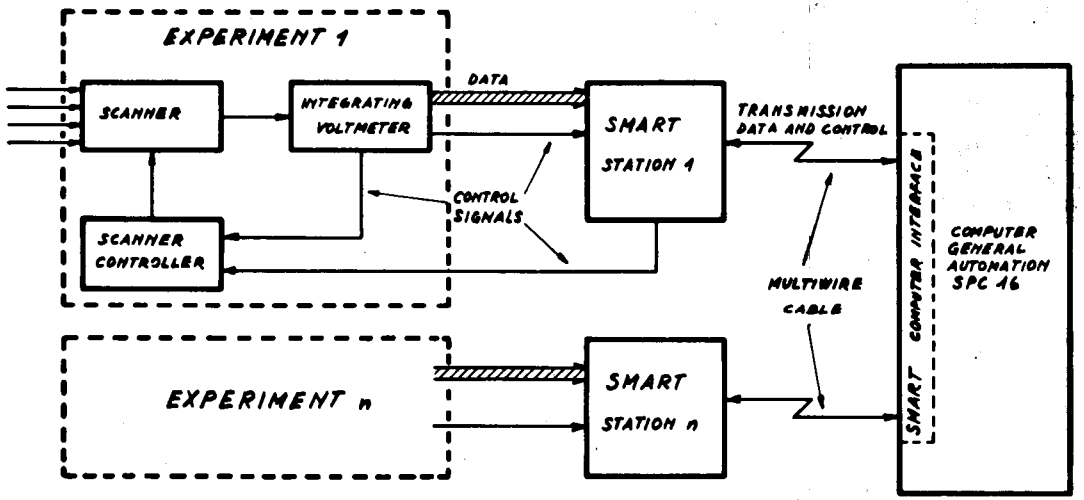


				FIG. 1
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C. C. R. EURATOM

PROGETTO: SMART SDS1			TITOLO: GENERAL CONFIGURATION
SCALA	VISTO	DATA 30-10-73	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 1

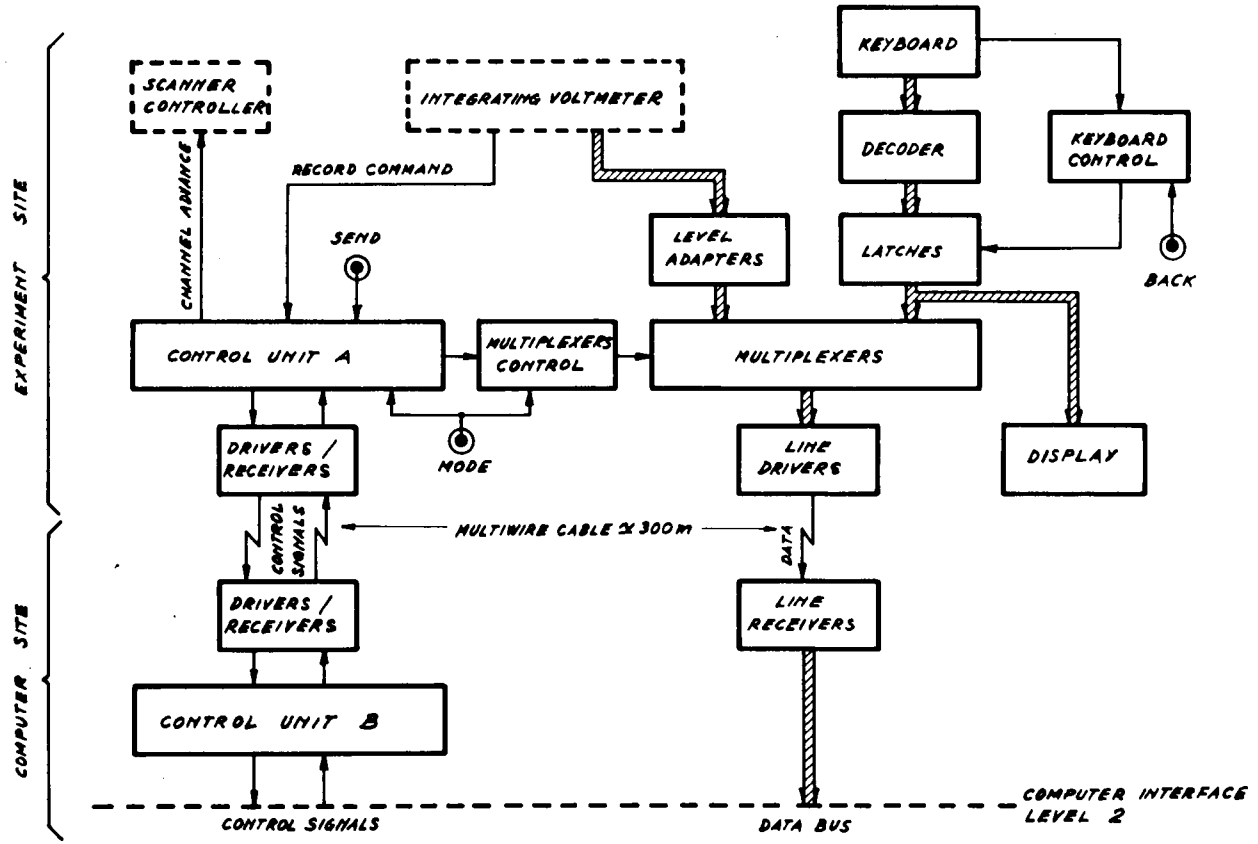


FIG. 2

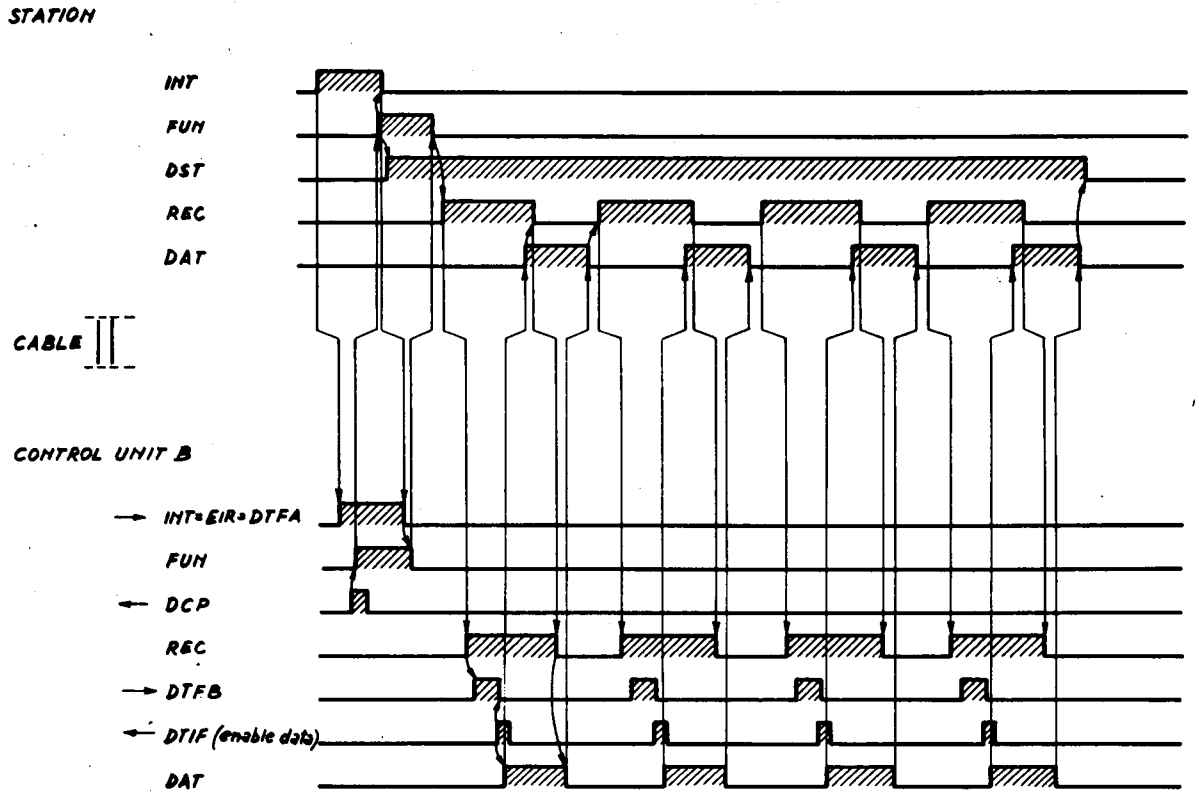
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C.C.R. EURATOM

PROGETTO	TITOLO
SMART SDS1	BLOCK DIAGRAM

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE 30-10-73	ME 042000002



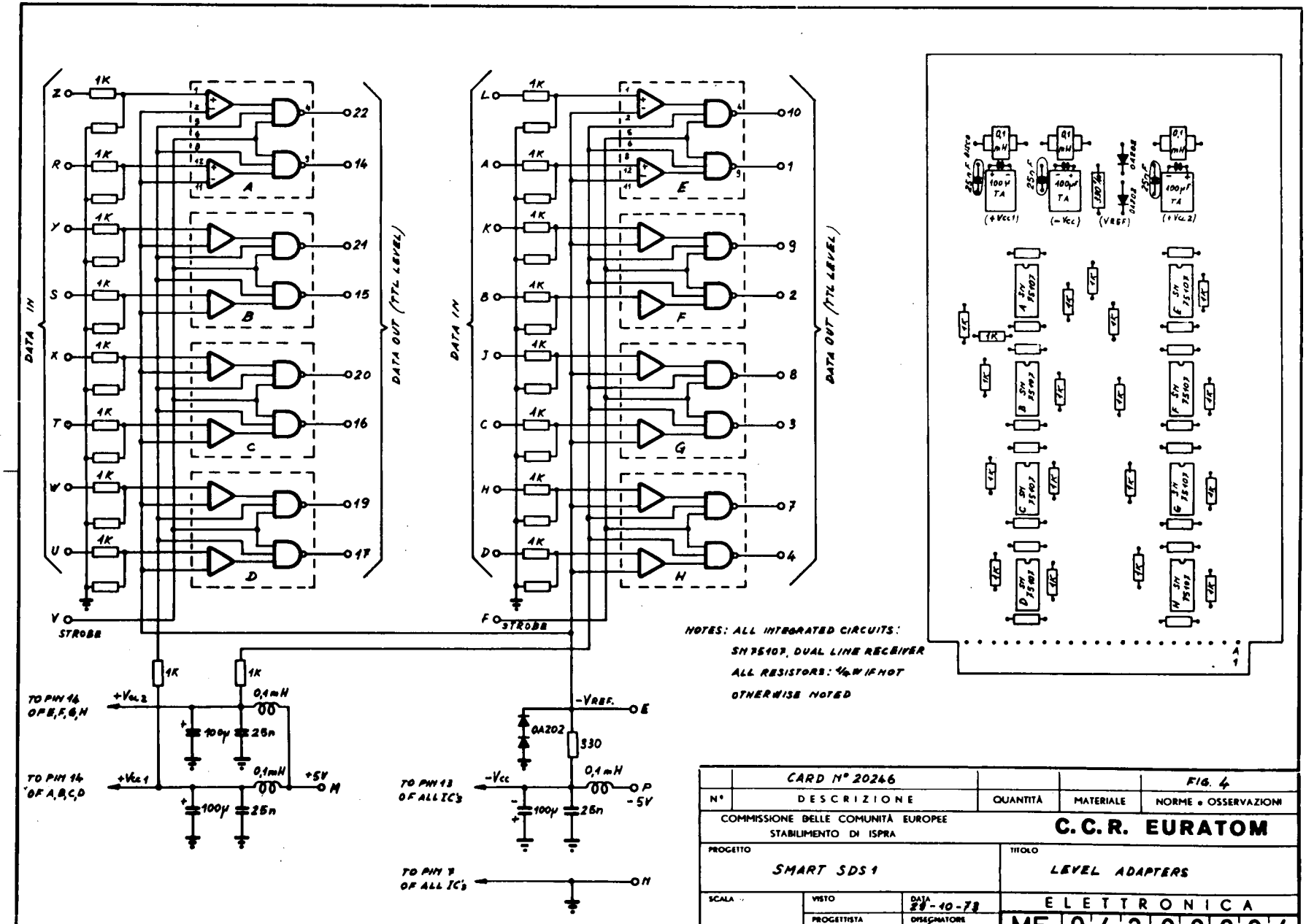
NOTES: → SIGNAL TO COMPUTER
← SIGNAL FROM COMPUTER
DELAY ON CABLE

				FIG. 3
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME • OSSERVAZIONI

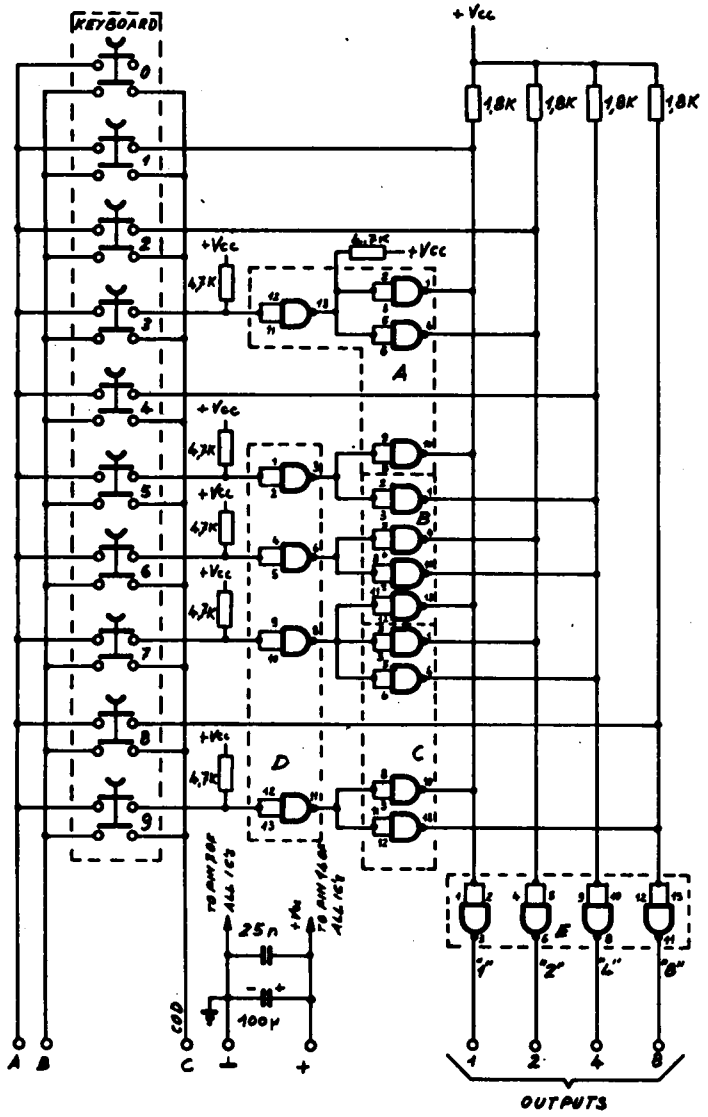
COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

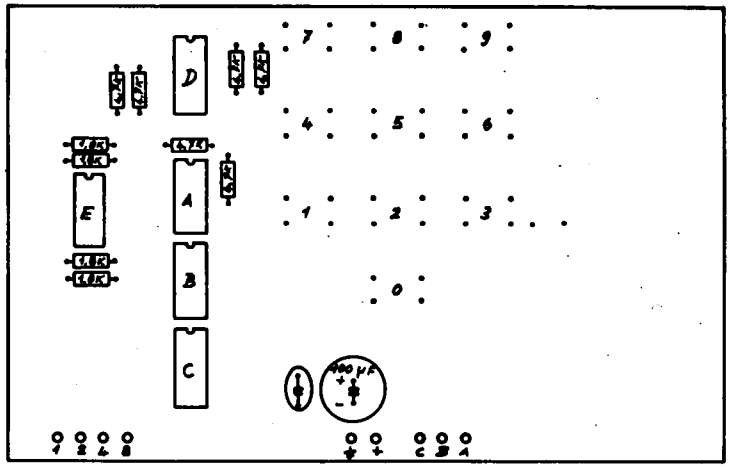
C. C. R. EURATOM

PROGETTO: SMART SDS1	TITOLO: TIMING STATION-COMPUTER
SCALA	VISTO / PROGETTISTA / DISEGNATORE: Peri / DATA: 30-10-73
	ELETTRONICA
	ME 0 4 2 0 0 0 0 3



	CARD N° 20246			FIG. 4
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA			C.C.R. EURATOM	
PROGETTO: SMART SDS 1			TITOLO: LEVEL ADAPTERS	
SCALA	VISTO	DATA 29-10-78	ELETTRONICA	
	PROGETTISTA	OSSERVATORE	ME 0 4 2 0 0 0 0 4	





NOTES: RESISTORS: 1/4 W
IC's: A, B, C = SN7401, QUAD TWO INPUT NAND GATE WITH OPEN COLLECTOR
D, E = SN7400, QUAD TWO INPUT NAND GATE

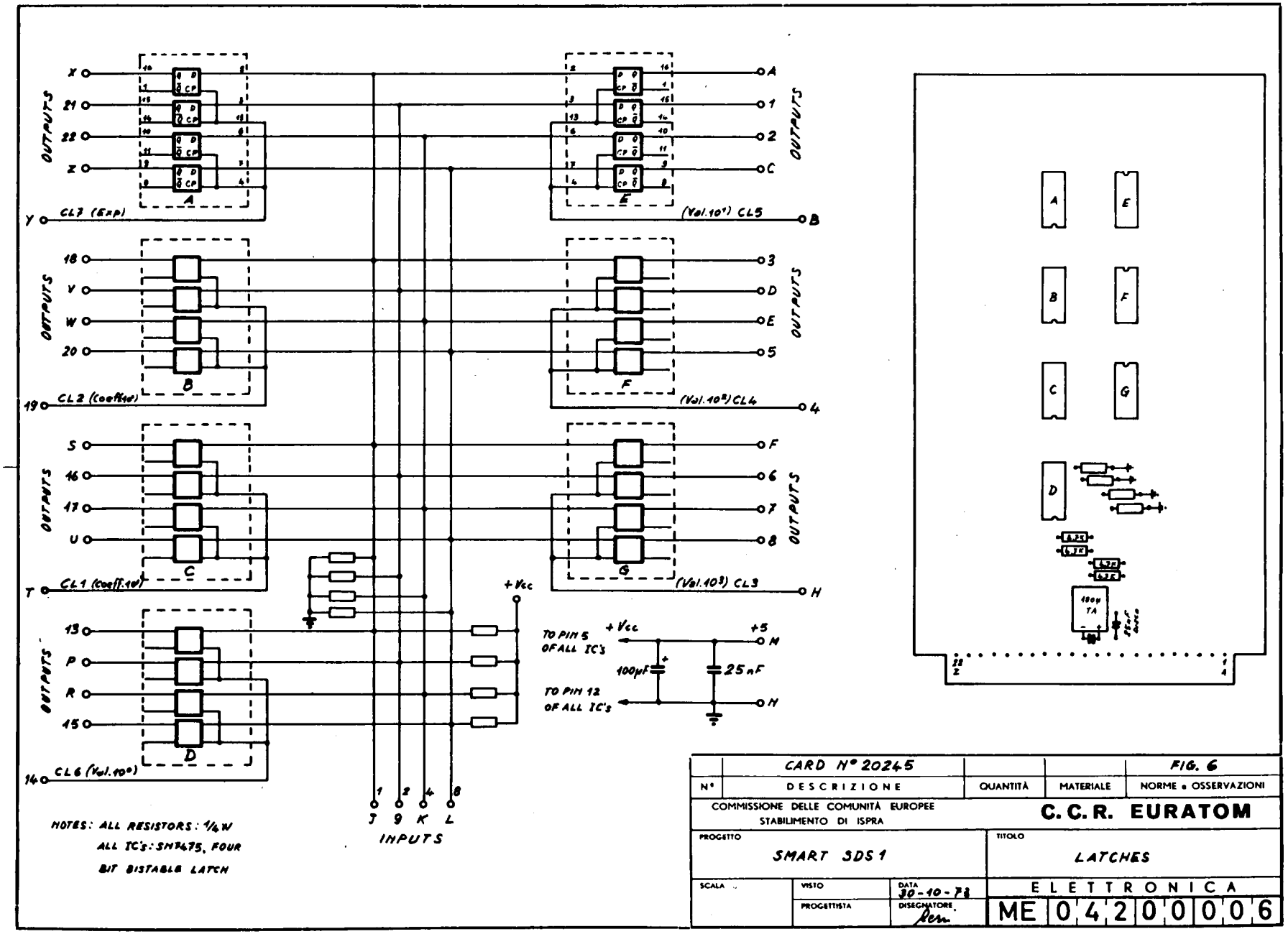
	CARD N° 20274			FIG. 5
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

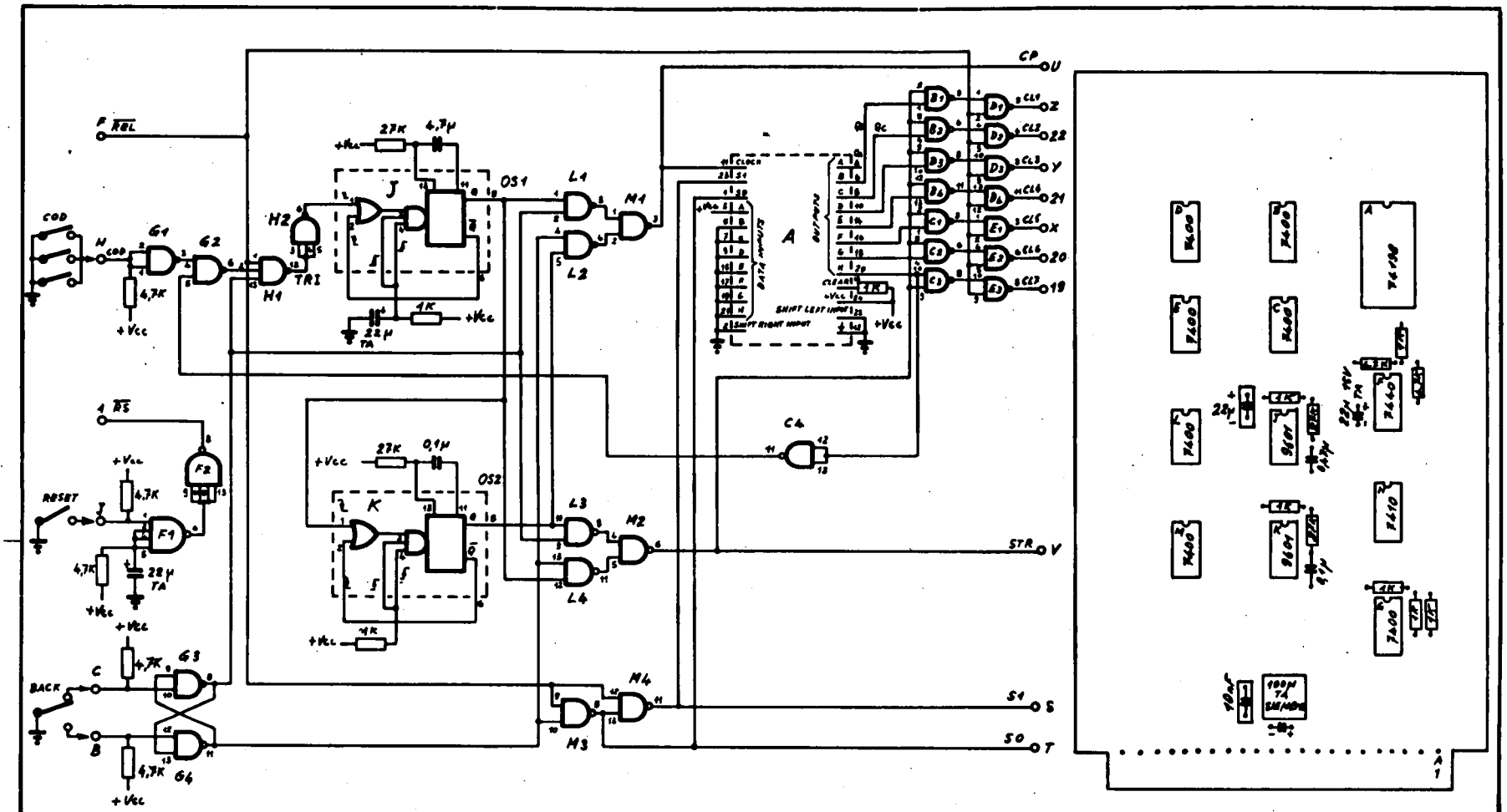
C.C.R. EURATOM

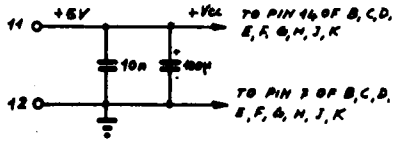
PROGETTO	TITOLO
SMART SDS1	DECODER

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 0 5



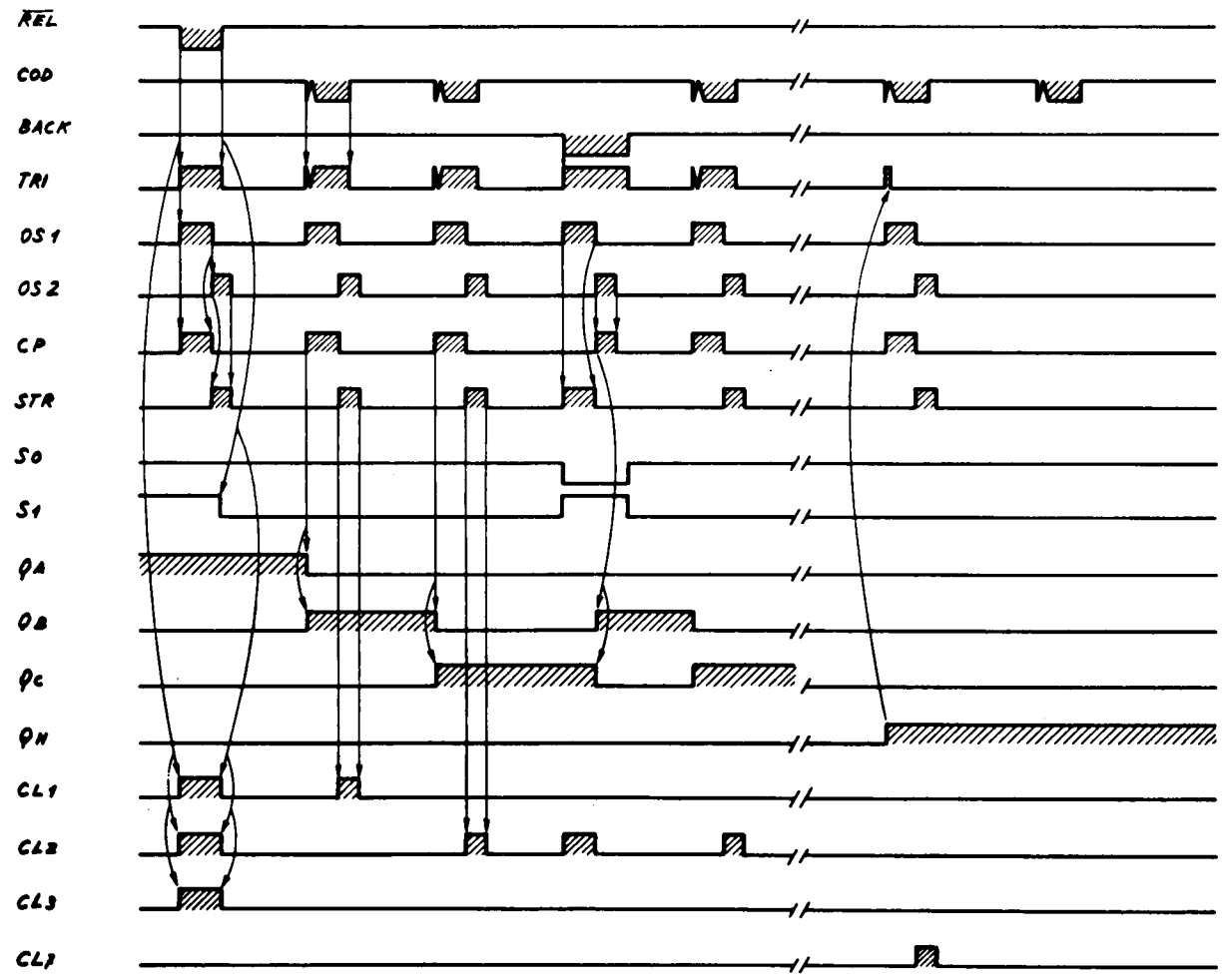
	CARD N° 20245			FIG. 6
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA				C.C.R. EURATOM
PROGETTO: SMART 3DS1			TITOLO: LATCHES	
SCALA	VISTO	DATA 30-10-78	ELETTRONICA	
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 0 6	





NOTES: ALL RESISTORS: ¼ W
IC's: A = SN74198 : 8-BIT PARALLEL-ACCESS LEFT-SHIFT RIGHT-SHIFT REGISTER
B, C, D, E, G, L, M: SN7400 : QUAD TWO INPUT NAND GATE
F = SN7440 : DUAL 4 INPUT NAND BUFFER
H = SN7410 : TRIPLE 3 INPUT NAND GATE
J, K = 9601 : RETRIGGERABLE ONE-SHOT

	CARD N°20261			FIG. 7
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA			C. C. R. EURATOM	
PROGETTO: SMART SDS1			TITOLO: KEYBOARD CONTROL	
SCALA	VISTO PROGETTISTA	DATA 29-10-73 DISEGNATORE	ELETTRONICA ME 0 4 2 0 0 0 0 7	



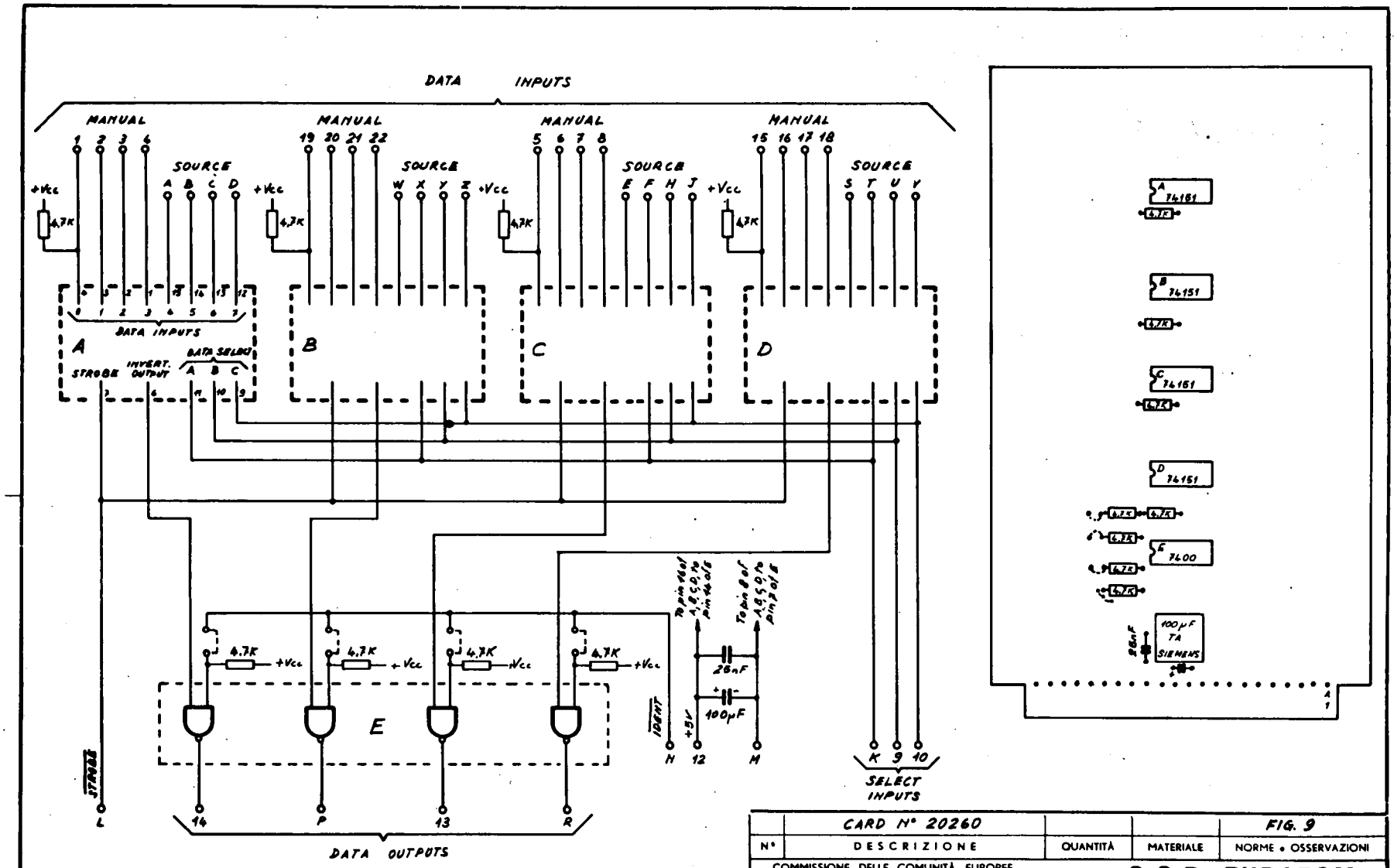
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	FIG. 8 NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C. C. R. EURATOM

PROGETTO	TITOLO
SMART SDS 1	TIMING KEYBOARD CONTROL

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 0 8



NOTE: IC's A, B, C, D = SN74151
8-LINE TO 1-LINE DATA
SELECTOR/MULTIPLEXER
E = SN7400, QUAD TWO
INPUT NAND GATE

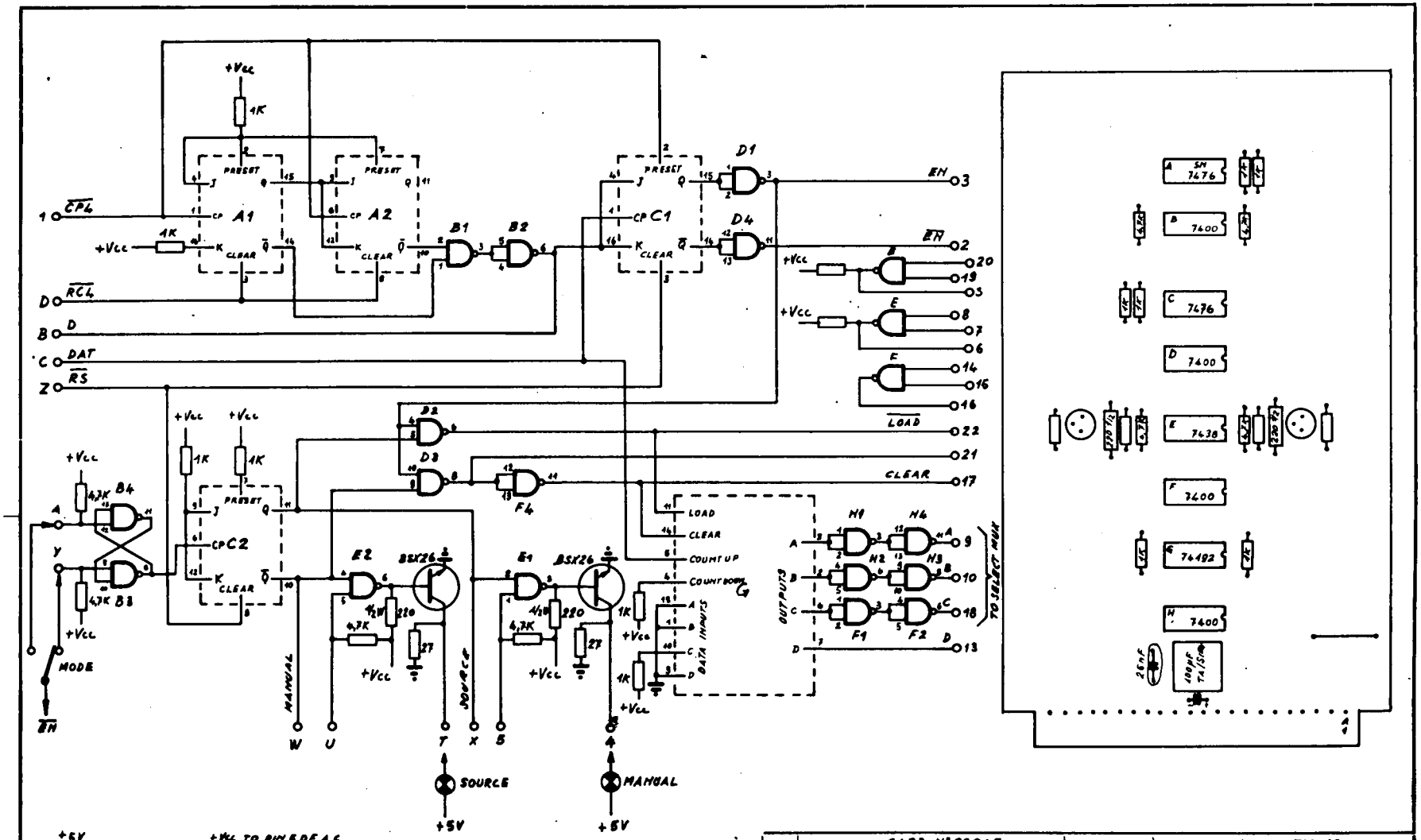
	CARD N° 20260			FIG. 9
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C. C. R. EURATOM

PROGETTO	TITOLO
SMART SDS1	MUTIPLEXERS

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE Peri	ME 0 4 2 0 0 0 0 9



NOTES: ALL RESISTORS 1/4W IF NOT OTHERWISE NOTED
IC's: A,C = SN7476, DUAL T-K FLIP-FLOP
B,D,F,H = SN7400, QUAD TWO INPUT NAND GATE
E = SN7438, QUAD TWO INPUT NAND BUFFER
G = SN74192, 4 BIT UP DOWN DECADE COUNTER.

	CARD N°20265			FIG. 10
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

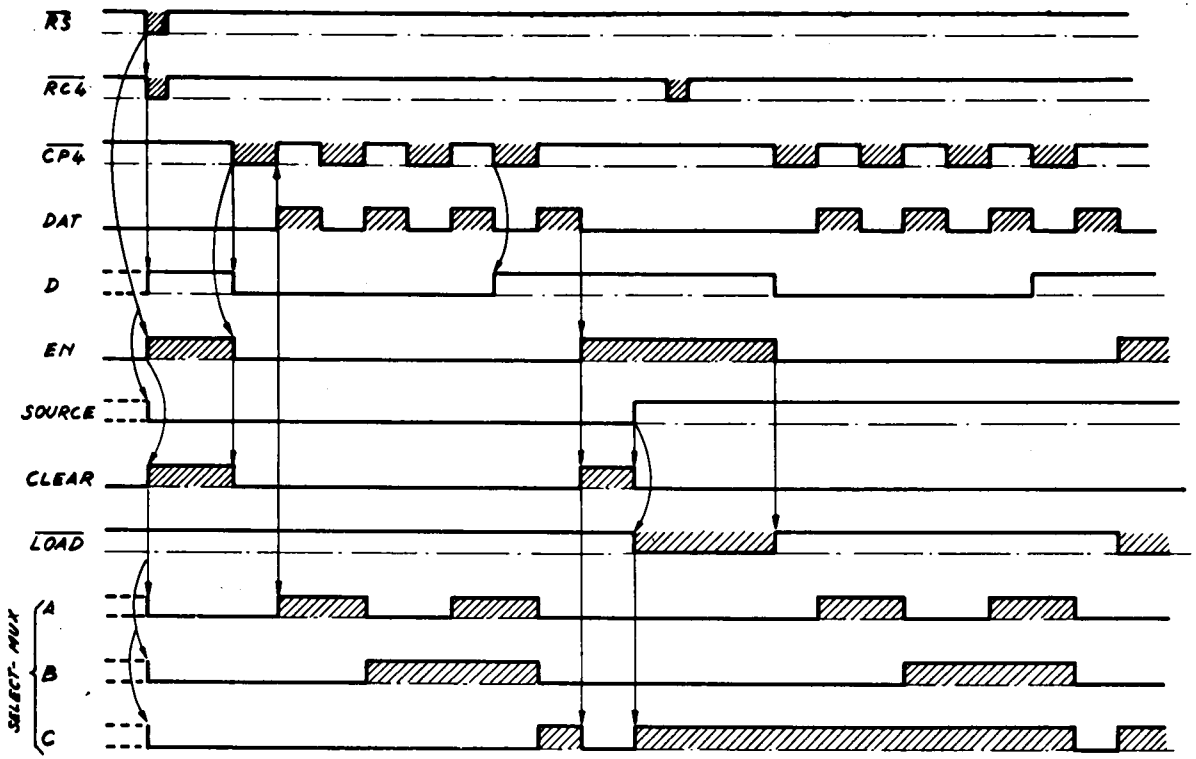
COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C.C.R. EURATOM

PROGETTO	SMART SDS1
TITOLO	MULTIPLEXER CONTROL
SCALA	
VISTO	
PROGETTISTA	
DATA	28-10-72
DISEGNATORE	lom

ELETTRONICA

ME 0 4 2 0 0 0 1 0



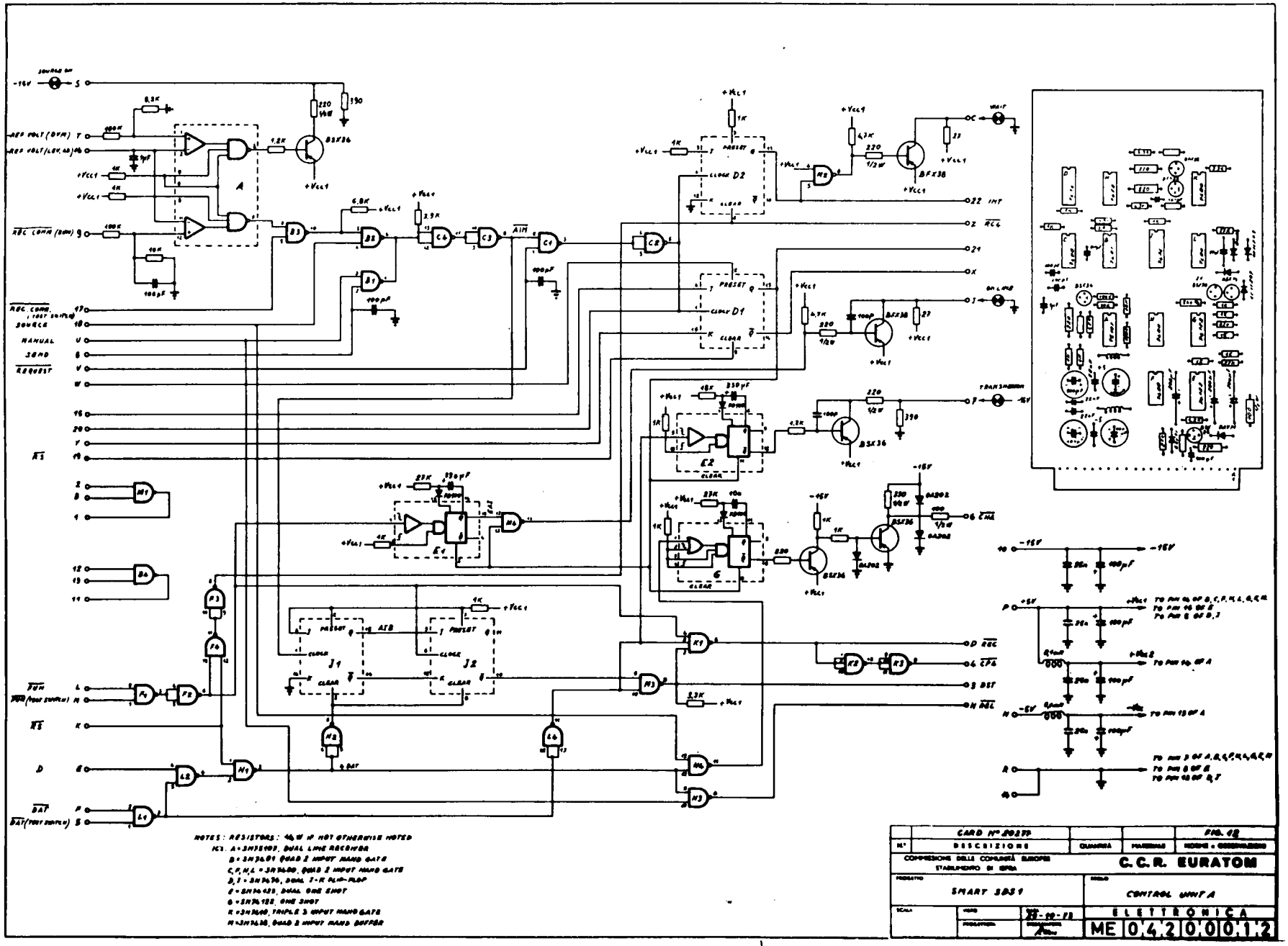
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	FIG. 11 NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C. C. R. EURATOM

PROGETTO	TITOLO
SMART SDS1	TIMING MULTIPLEXER CONTROL

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 1 1


NOTES: RESISTORS: ¼W IF NOT OTHERWISE NOTED
IC's. A = SN75107, DUAL LINE RECEIVER
B = SN7401 QUAD 2 INPUT NAND GATE
C, F, H, L = SN7400, QUAD 2 INPUT NAND GATE
D, J = SN7470, DUAL J-K FLIP-FLOP
E = SN74123, DUAL ONE SHOT
G = SN74122, ONE SHOT
K = SN7410, TRIPLE 3 INPUT NAND GATE
M = SN7438, QUAD 2 INPUT NAND BUFFER
CARD N° 20279
FIG. 42
DESCRIZIONE
COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA
C.C.R. EURATOM
SMART SB31
CONTROL UNIT A
ELETTRONICA
ME 0.4.2.0.0.1.2

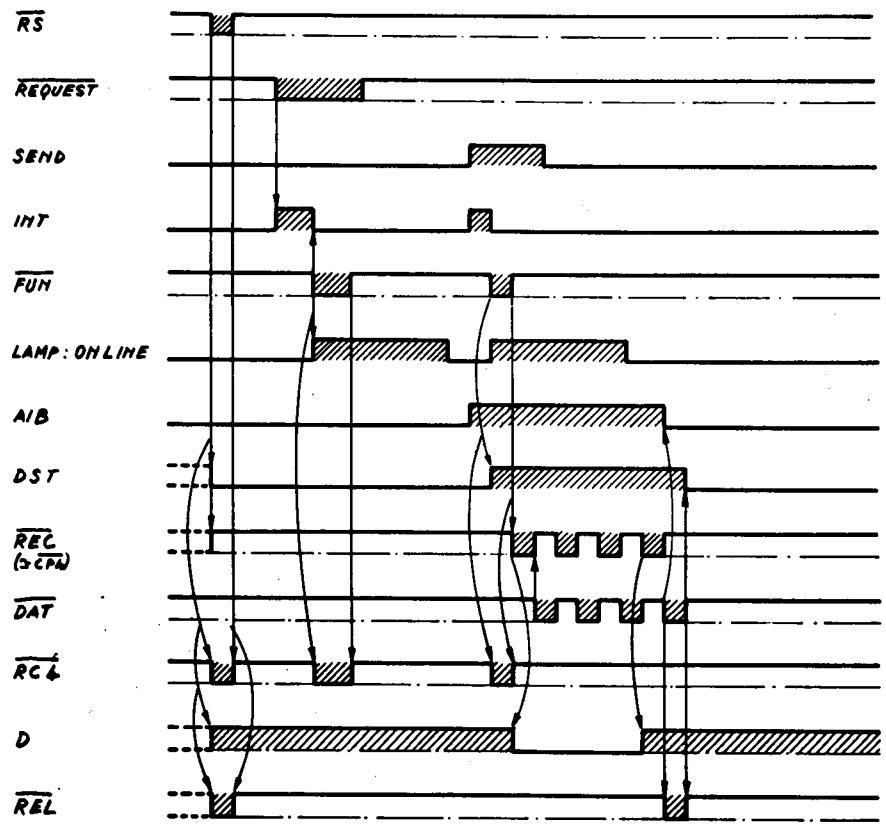
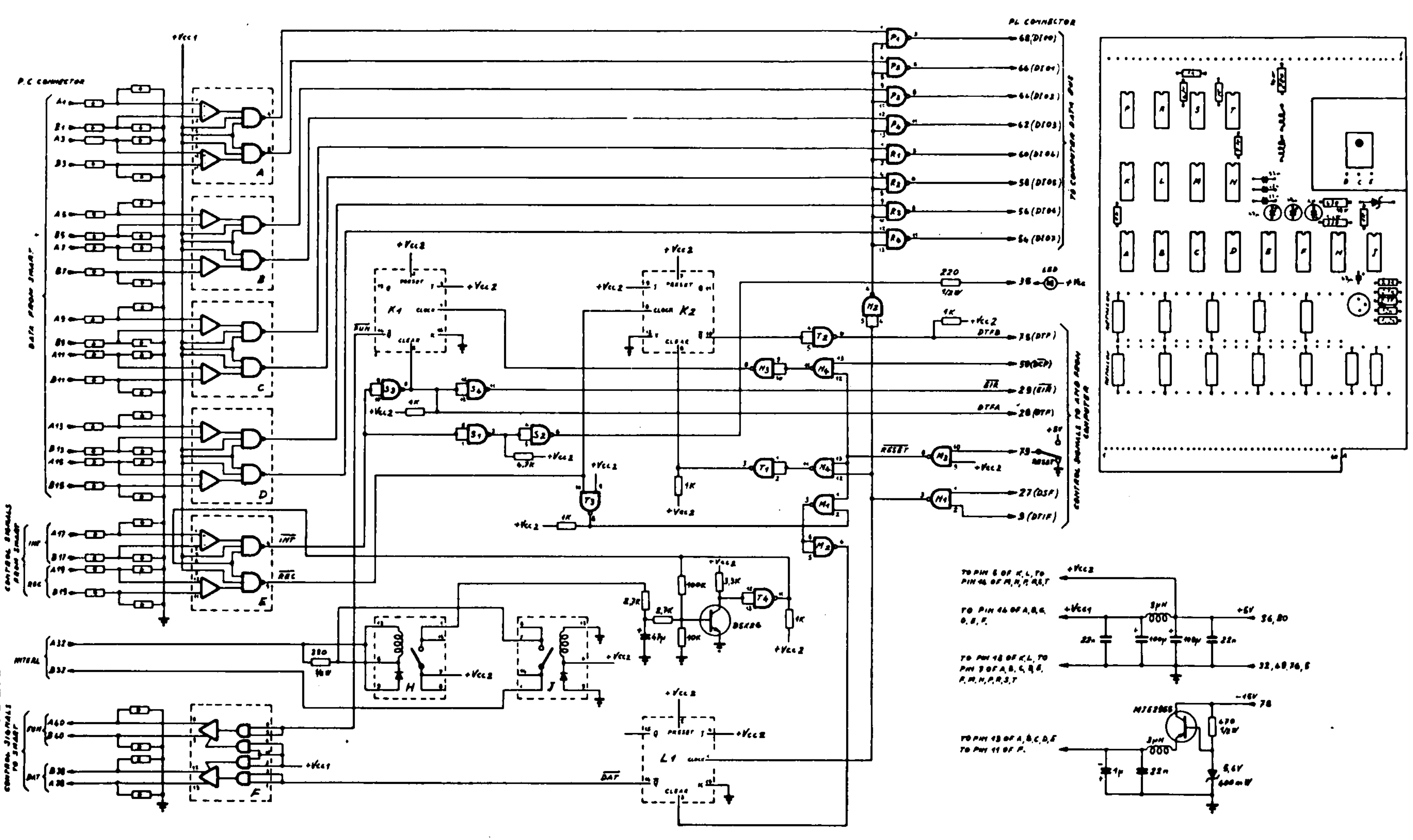


				FIG. 13
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

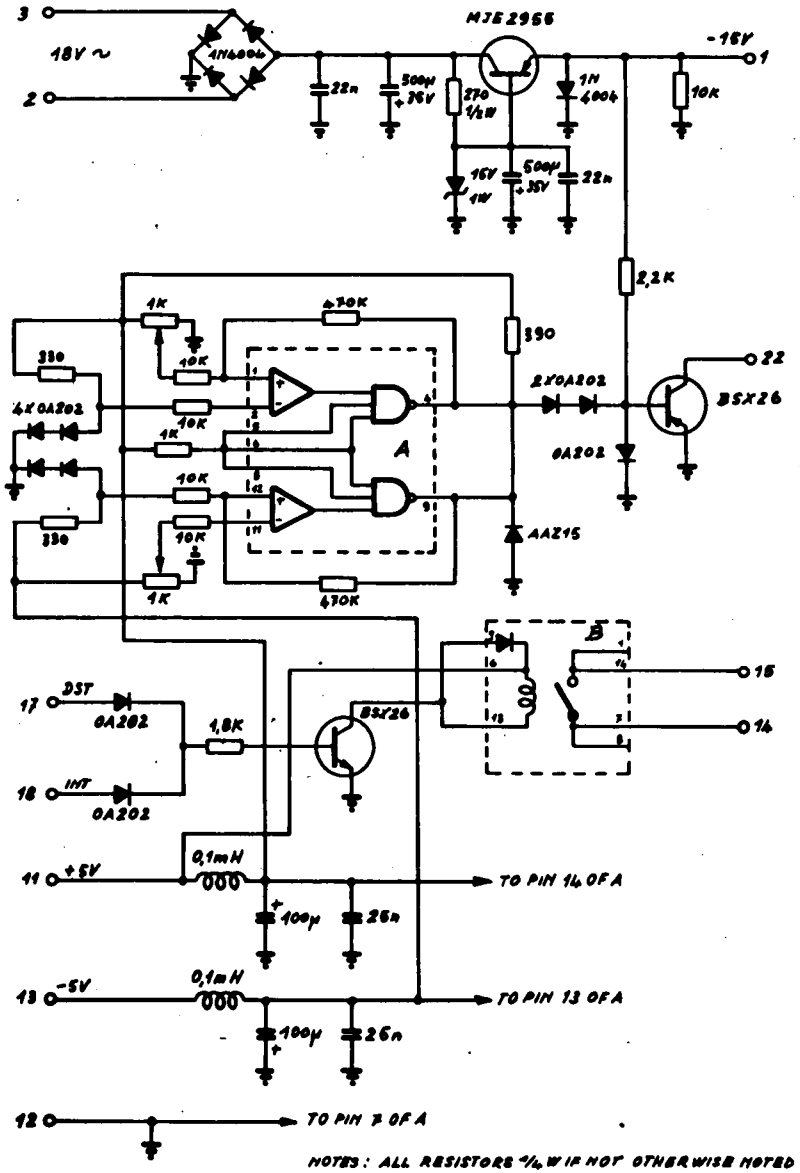
C. C. R. EURATOM

PROGETTO: SMART SDS1			TITOLO: TIMING CONTROL UNIT A (POSITION. MANUAL°)
SCALA	VISTO	DATA 30-10-78	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 1 3

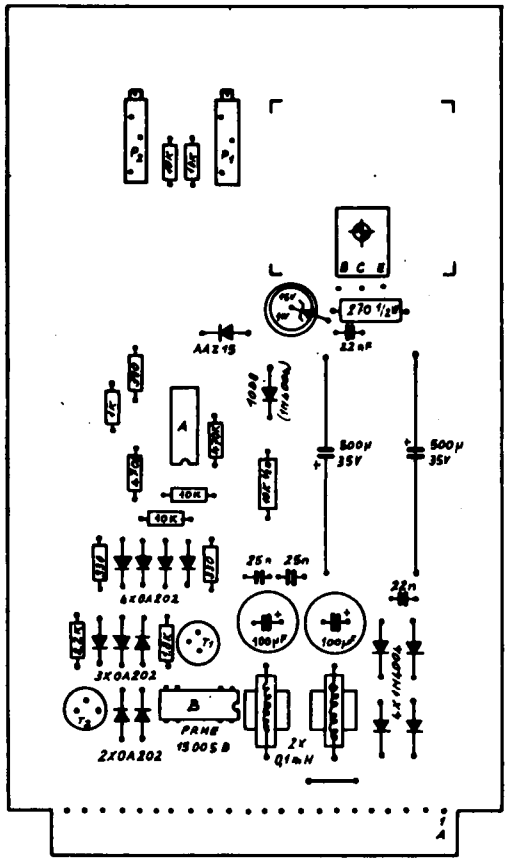


NOTES: ◆ METAL FILM RESISTOR
OTHER RESISTORS ¼ W IF
NOT OTHERWISE NOTED
ICS: A,B,C,D,E : SN75107, DUAL LINE RECEIVER
F = SN 75440, DUAL LINE DRIVER
K,L = SN7476, DUAL
J-K FLIPFLOP (SECOND
FLIP-FLOP OF L NOT USED)
M,N : SN7400 QUAD 2 INPUT
NAND GATE
P,R,S,T : SN7438, QUAD 2 INPUT
NAND BUFFER
RELAY H, J : PRME 15005B
(14 PIN DUAL-IN-LINE PACKAGE)

	CARD N° 20392			FIG. 14
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA		C.C.R. EURATOM		
PROGETTO: SMART SD31		TITOLO: CONTROL UNIT B		
SCALA	VISTO / PROGETTISTA	DATA: 16-10-73 / DISEGNATORE	ELETTRONICA	ME 0420 0014



NOTES: ALL RESISTORS 1/4 W IF NOT OTHERWISE NOTED
A = SN75108, DUAL LINE RECEIVER
B = RELAYS PRME 15005 B (16 PIN DUAL IN LINE PACKAGE)

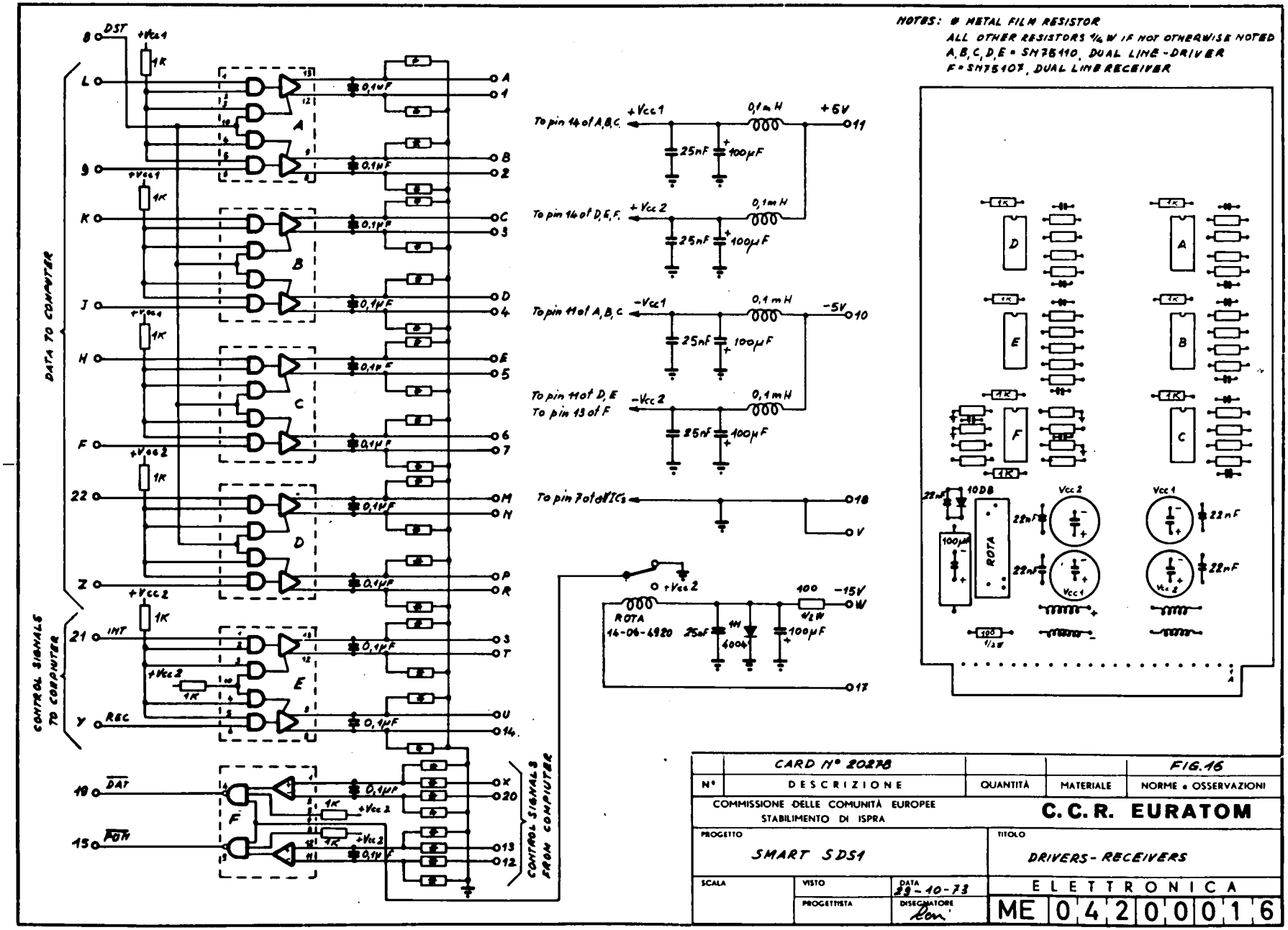


	CARD N° 20394			FIG. 16
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

C.C.R. EURATOM

PROGETTO: SMART SDS1	TITOLO: POWER SUPPLY -15V, 0,2A
SCALA	VISTO / PROGETTISTA
DATA: 29-10-73	DISEGNATORE: Mon
ELETTRONICA	ME 0 4 2 0 0 0 1 5



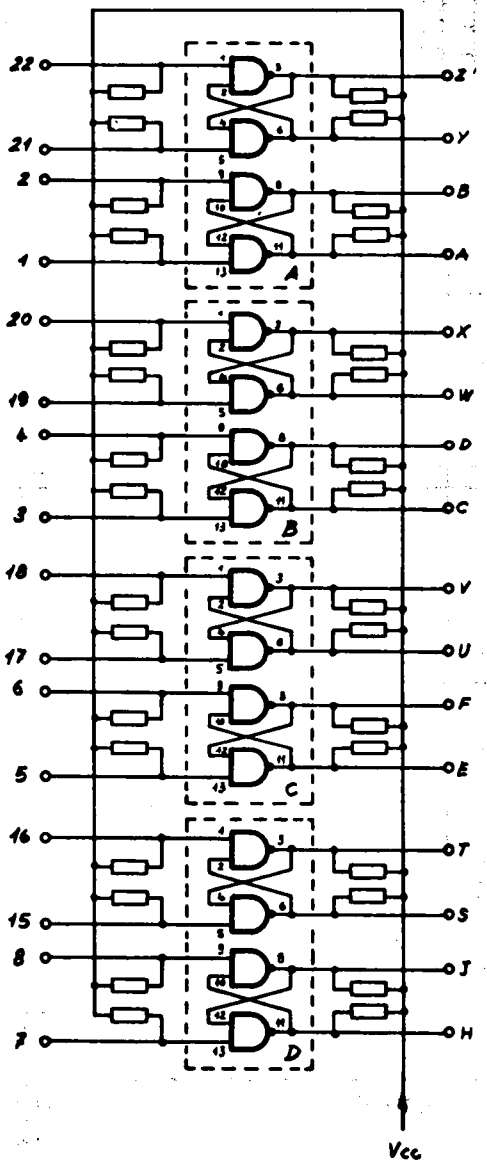
	CARD N° 20278			FIG. 16
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI

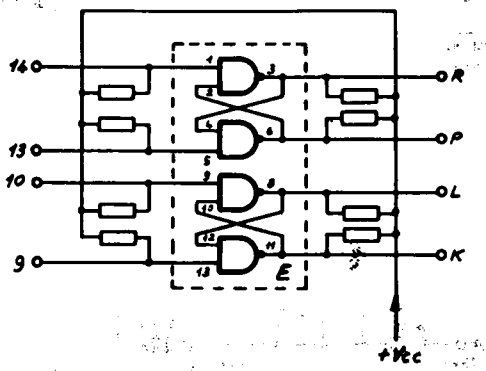
COMMISSIONE DELLE COMUNITÀ EUROPEE
STABILIMENTO DI ISPRA

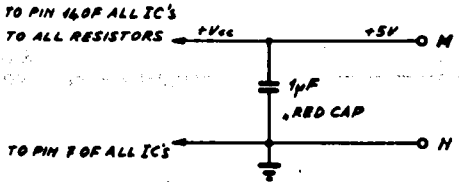
C. C. R. EURATOM

PROGETTO	TITOLO
SMART SDS1	DRIVERS - RECEIVERS

SCALA	VISTO	DATA	ELETTRONICA
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 1 6

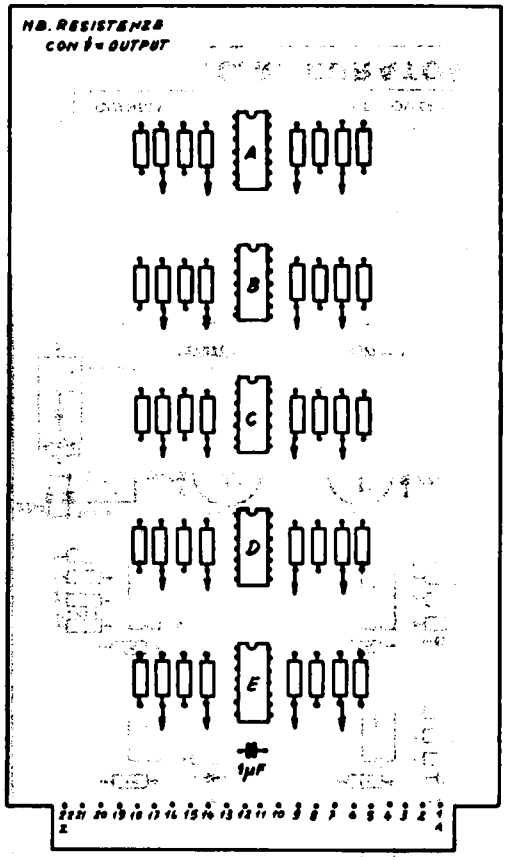




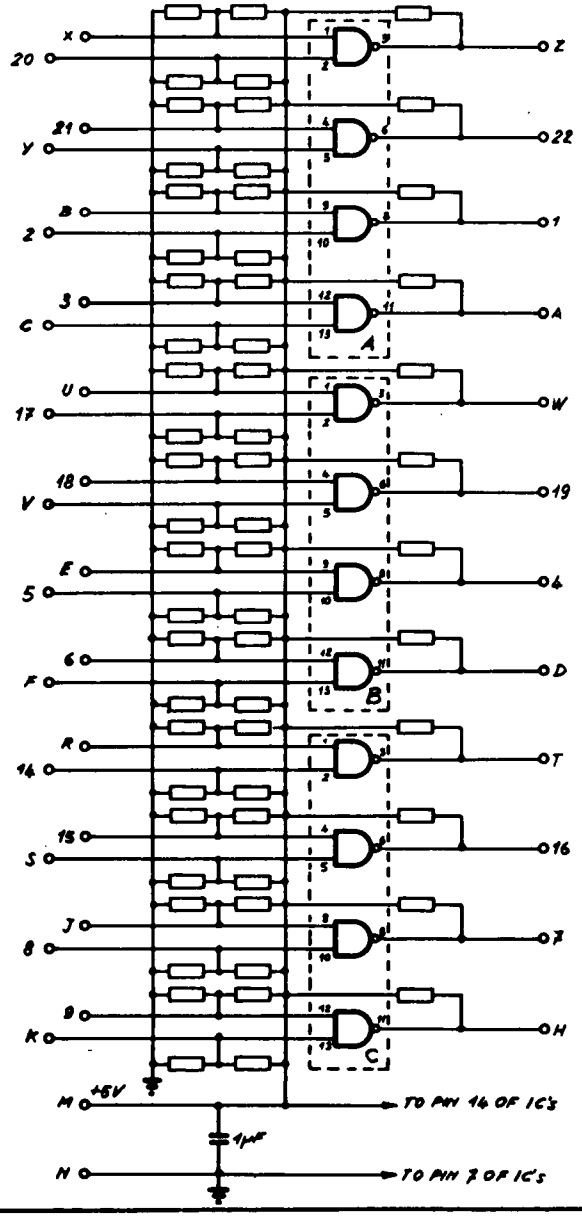


NOTES - ALL RESISTORS: 1/4 W

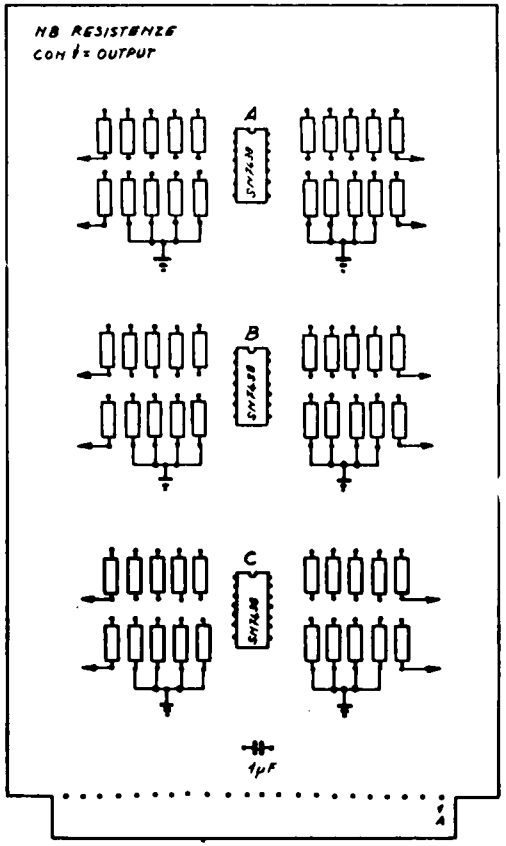
- IC's : SN7400 OR SN7438



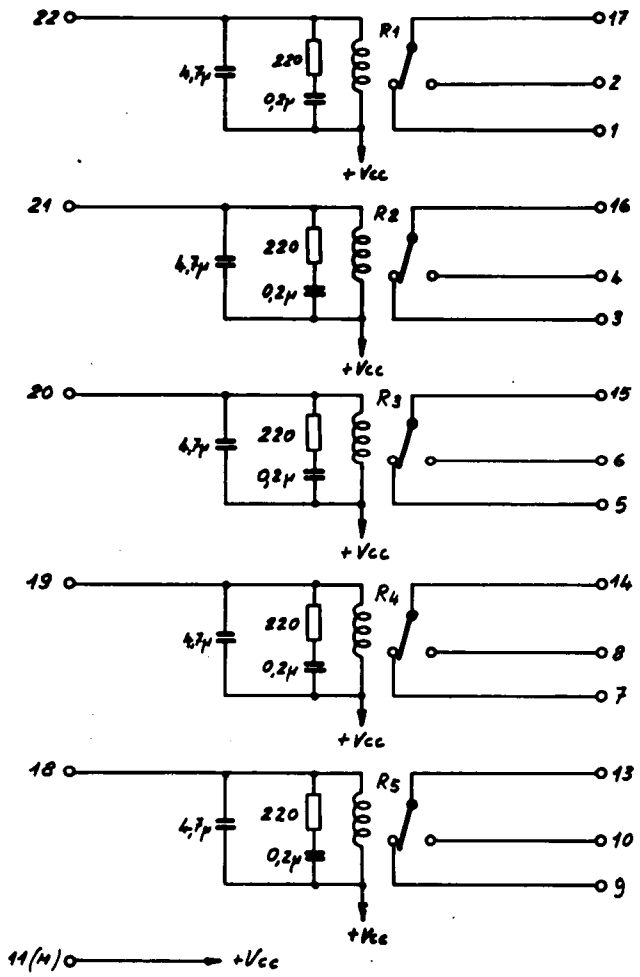
	CARD N° E20396			FIG. 17
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA				C.C.R. EURATOM
PROGETTO: SMART SDS1			TITOLO: S-R FLIP-FLOPS	
SCALA	VISTO PROGETTISTA	DATA 20-10-78 DISEGNATORE	ELETTRONICA	
			ME 0 4 2 0 0 0 1 7	



NOTES: ALL RESISTORS: 1/4 W
ALL IC's: SN7438
QUAD 2 INPUT
NAND BUFFER

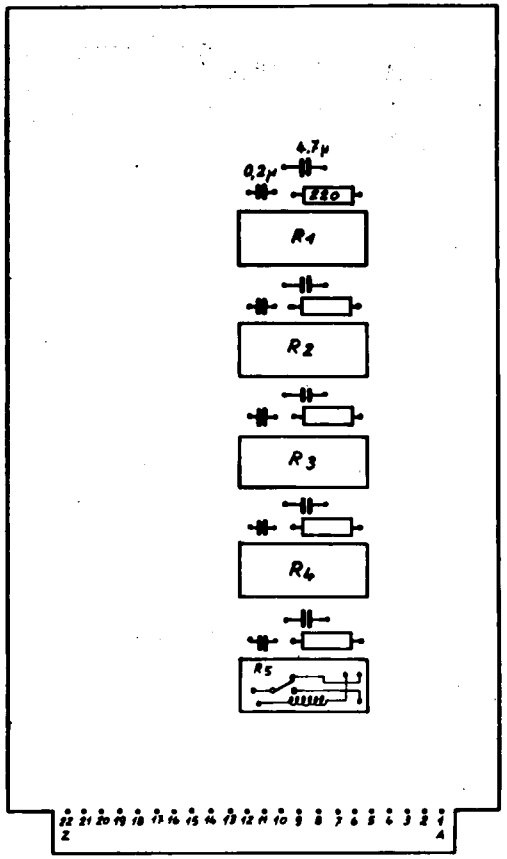


	CARD N° 20395			FIG. 18
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA				C.C.R. EURATOM
PROGETTO: SMART SDS1			TITOLO: BUFFERS	
SCALA	VISTO PROGETTISTA	DATA 30-10-73 DISEGNATORE	ELETTRONICA	
			ME 0 4 2 0 0 0 1 8	



NOTES: RELAYS "ROTA" 14-06-4920

RESISTORS: 1/2 W



	CARD N° 20393			FIG. 19
N°	DESCRIZIONE	QUANTITÀ	MATERIALE	NORME e OSSERVAZIONI
COMMISSIONE DELLE COMUNITÀ EUROPEE STABILIMENTO DI ISPRA				C.C.R. EURATOM
PROGETTO: SMART SDS1			TITOLO: RELAY CARD	
SCALA	VISTO	DATA 30-10-73	ELETTRONICA	
	PROGETTISTA	DISEGNATORE	ME 0 4 2 0 0 0 1 9	

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