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G. Corradi, L. Passamonti and V. Russo:
LAB 80 SYSTEM: A PROGRAMMABLE AND/OR ECL UNIT
(CPR 001).

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ABSTRACT.

The method of sending differential signals (both analogue and digital ones) via twisted pair becomes widely used in high energy experiments. We describe design, circuitry and performances of a programmable AND/OR ECL unit, which features ECL inputs and both ECL/NIM outputs.

1. - REMARKS ON ECL SPECIFICATIONS.

In what follows we summarize the technical specifications about ECL frontpanel interconnections which have been proposed by CERN as a standard, or have been adopted by many experimental groups. In fact ECL circuitry is becoming largely diffused for the high integration density, which reduces the cost per channel, the low price of cable and connectors, the high speed and high noise immunity.

These characteristics are particularly suited for the present high energy physics experiment.

a) Drivers.

The drivers to be used should be of the 10116, 10101, 10105, 10216 or similar type, to guarantee 1.6 Volts level on 100Ω impedance. At present the main ECL producer is Motorola, with the 10000 series, which is compatible with MECL III, Fairchild F100K and F95K, Plessey Pecl III, etc.

b) Terminations.

The pull-down resistor must guarantee the full swing of 1.6 Volt or 16 mA on 100Ω . Typical resistor value for drivers are 330Ω for the -6 V and 270Ω for -5.2 V. For receivers a

1 K Ω resistor from the negative input side to ground also is allowed to obtain the required input offset (70 mV) in absence of signal.

c) Signal levels.

Signals should be differential or balanced of 1.6 Volts. Nominally

$$V_H = - 0.9 \text{ V} , \quad V_L = - 1.7 \text{ V}.$$

d) Cables.

Single or multitwisted cables with 100 Ω impedance can be used. Where cross-talk problems are irrelevant, the cables can also be non-twisted. Cable cross section is typically 0.22 mm².

e) Connectors.

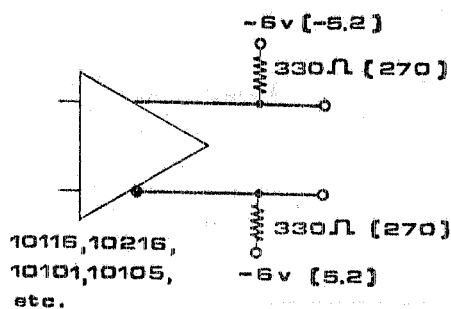
The male connector (0.6x0.6 mm pin) should be mounted on the front panel, the female on the cable. They can be of the AMPMODU Locking-Clip style or equivalent.

For the modules we described, we used the following connectors :

- AMP 280358 - female connector ,
- AMP 181270 - pin ,
- AMP 280370 - male connector .

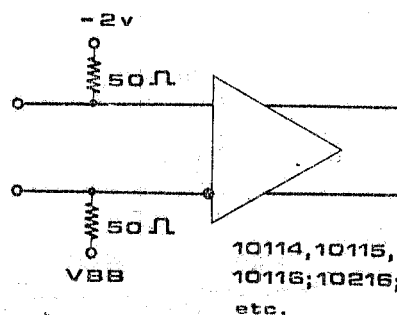
They are single low cost connectors, allows an easy access to channels, and are generally used. The cables are single twisted pair with 100 \pm 5% impedance. The attenuation for 40 nsec pulses over 100 meters is less than 75%. The propagation time is 5.7 \pm 0.5 nsec for meter.

A few usefull, widely used interface circuits are shown in Figs. 1 to 7.



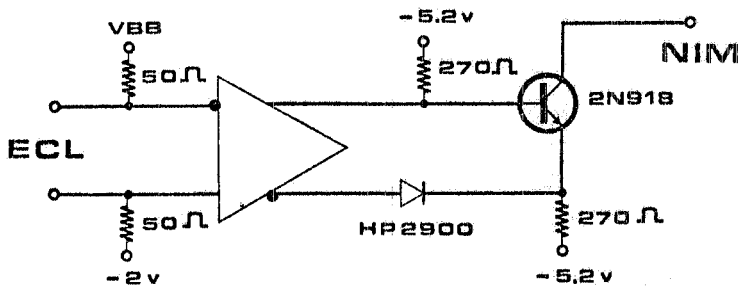
DRIVER A (B)

FIG. 1



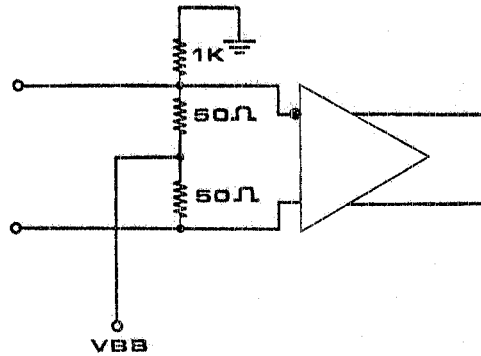
RECEIVER A

FIG. 2



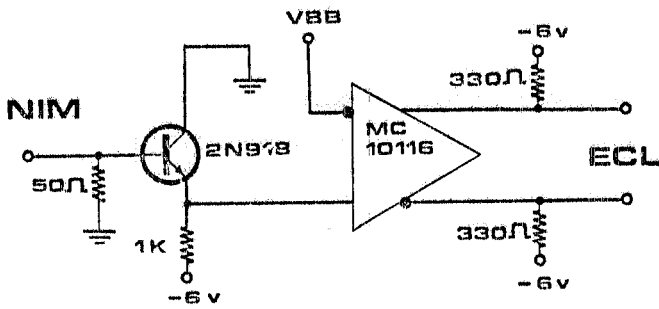
ADAPTER ECL NIM

FIG. 3



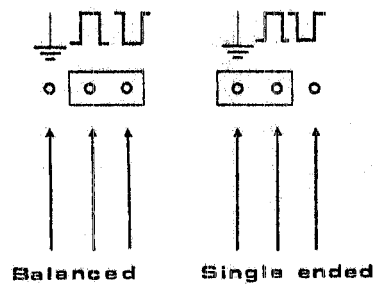
RECEIVER B

FIG. 4



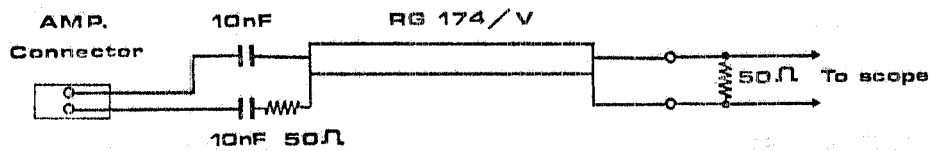
ADAPTER NIM ECL

FIG. 5



ADDITIONAL GROUND PIN

FIG. 6



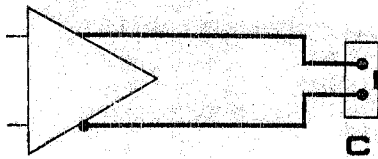
ADAPTER FOR OSCILLOSCOPE

FIG. 7

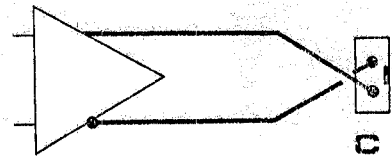
2. - 32 IN 8 OUT OR/AND PROGRAMMABLE ECL UNIT (CPR 001). GENERAL DESCRIPTION.

This unit performs the logic AND/OR functions on eight output channels. Each of the eight outputs is individually programmable by plugging in appropriate jumpers on the card board, giving the OR function (or AND function) of the selected inputs (up to 32). Each input signal can be programmed on up to three outputs channels performing the same logical function (AND or OR).

The AND function is operative when input and outputs signals are inverted by means of suit ed external bridge-connectors (see Fig. 8).



POSITIVE INPUT



NEGATIVE INPUT

C: CONNECTOR AMP 280370

FIG. 8

Each of the eight AND/OR channels has a FAN-OUT multiplicity of three (two ECL and one NIM output timed).

When all the channels of one unit are working in the same logic mode (AND or OR) the whole unit can be set in "strobed" mode by means of a rear switch.

Internally, the unit uses emitter-oring to perform the logical functions. To each output channel is associated a bus doubly terminated into its characteristic impedance, onto which the jumper connections are made.

The unit modularity is one NIM-SLOT.

The front view of the unit is shown in Fig. 9. The compactness of circuitry the internal construction can be appreciated on board picture (see Fig. 10). On Fig. 11 we report the electrical diagram.

SPECIFICATIONS

INPUTS	:	32 ECL (AMP 280370-2 connectors)
OUTPUTS	:	8 channels each one having two ECL outputs and one NIM
RISE TIME	:	2.5 nsec 10% 90%
FALL TIME	:	2.5 nsec 10% 90%
PULSE DURATION	:	reflects the width of the input pulses using the appropriate function (AND/OR)

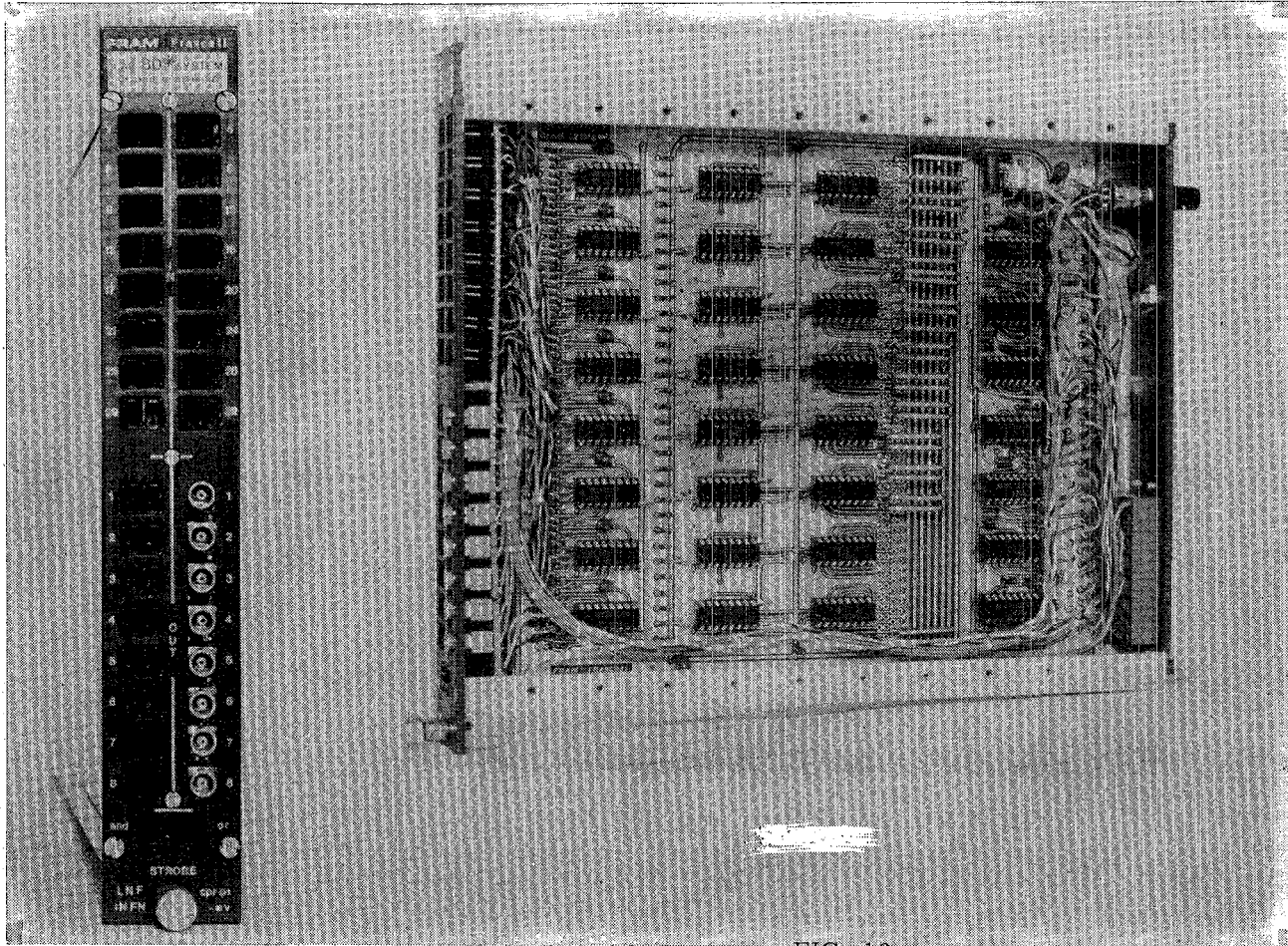


FIG. 10

FIG. 9

DELAY	:	14 nsec ECL, 14 nsec NIM, matched from output to output
STROBE	:	ECL input signal. Same delay as input signal
MAX RATE	:	100 MHz
POWER SUPPLY	:	- 6 V, 1500 mA

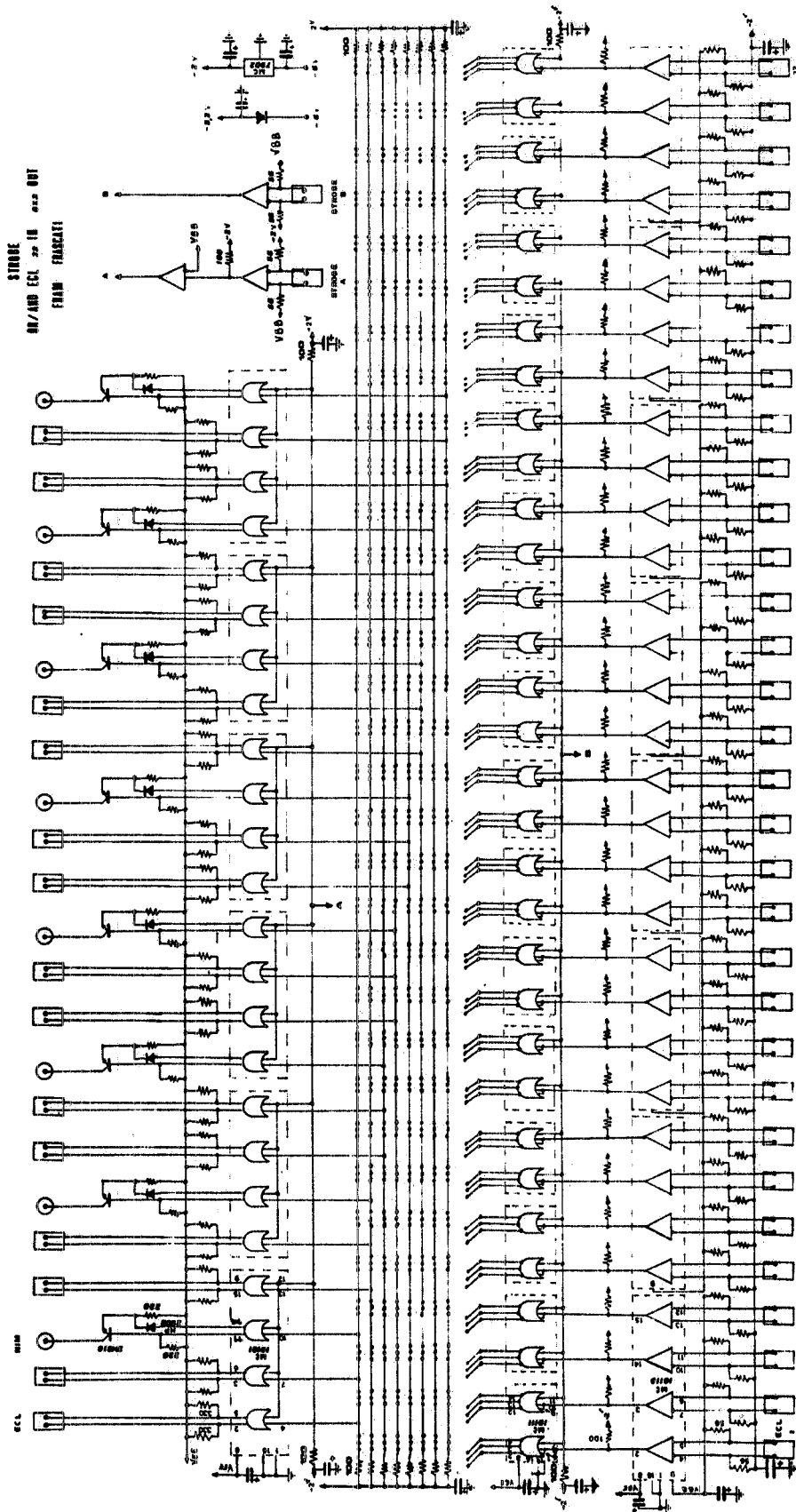


FIG. 11