ISTITUTO NAZIONALE DI FISICA NUCLEARE
Laboratori Nazionali di Frascati

LNF-81/24(NT)
20 Maggio 1981

G. Corradi, L. Passamonti and V. Russo:

# LAB 80 SYSTEM: AN ECL/NIM ADAPTER AND FAN-OUT (CPR 002).

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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 FAN-OUT and adapter ECL unit, which is useful for compatibility with NIM-level modules.

## 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 largerly 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 100 Ω impedence. 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 100 Ω. Typical resistor value for drivers are 330 Ω for the - 6 V and 270 Ω for - 5.2 V. For receivers a

1 KΩ 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

$$V_H = -0.9\ V\ , \qquad V_L = -1.7\ V.$$

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 $mm^2$.

e) Connectors.

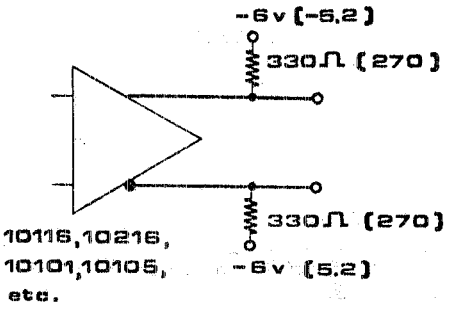
The male connector (0.6 x 0.6 mm pin) should be mounted on the front panel, the female on the cable. They can be of the AMPMODU Locking-Clip style or equivalent.

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

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

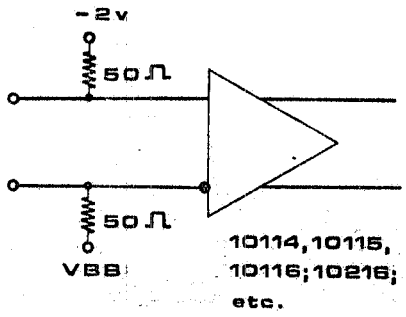
They are single low cost connectors, allows an easy access to channels, and are generally used. The cables are single twisted pair with 100 ± 5% impedance. The attenuation for 40 nsec pulses over 100 meters is less than 75 %. The propagation time is 5.7 ± 0.5 nsec for meter.

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



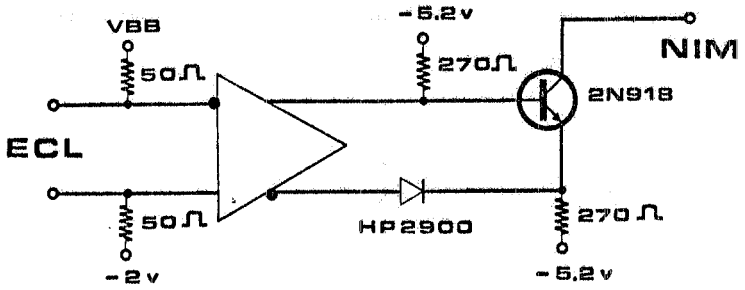

DRIVER A (B)

FIG. 1



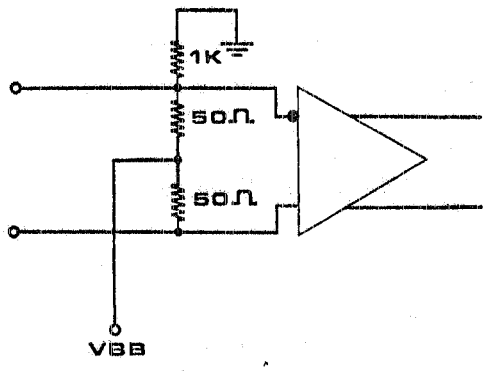

RECEIVER A

FIG. 2



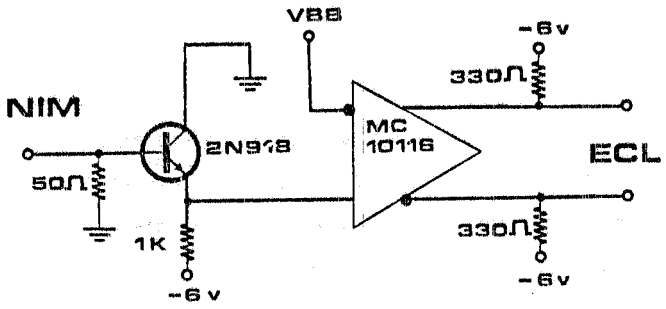

ADAPTER ECL NIM

FIG. 3



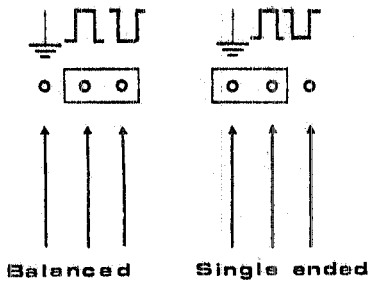

RECEIVER B

FIG. 4



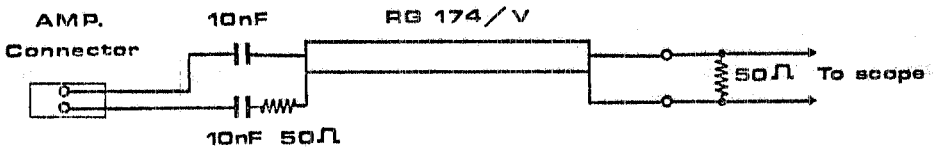

ADAPTER NIM ECL

FIG. 5




ADDITIONAL GROUND PIN

FIG. 6




ADAPTER FOR OSCILLOSCOPE

FIG. 7

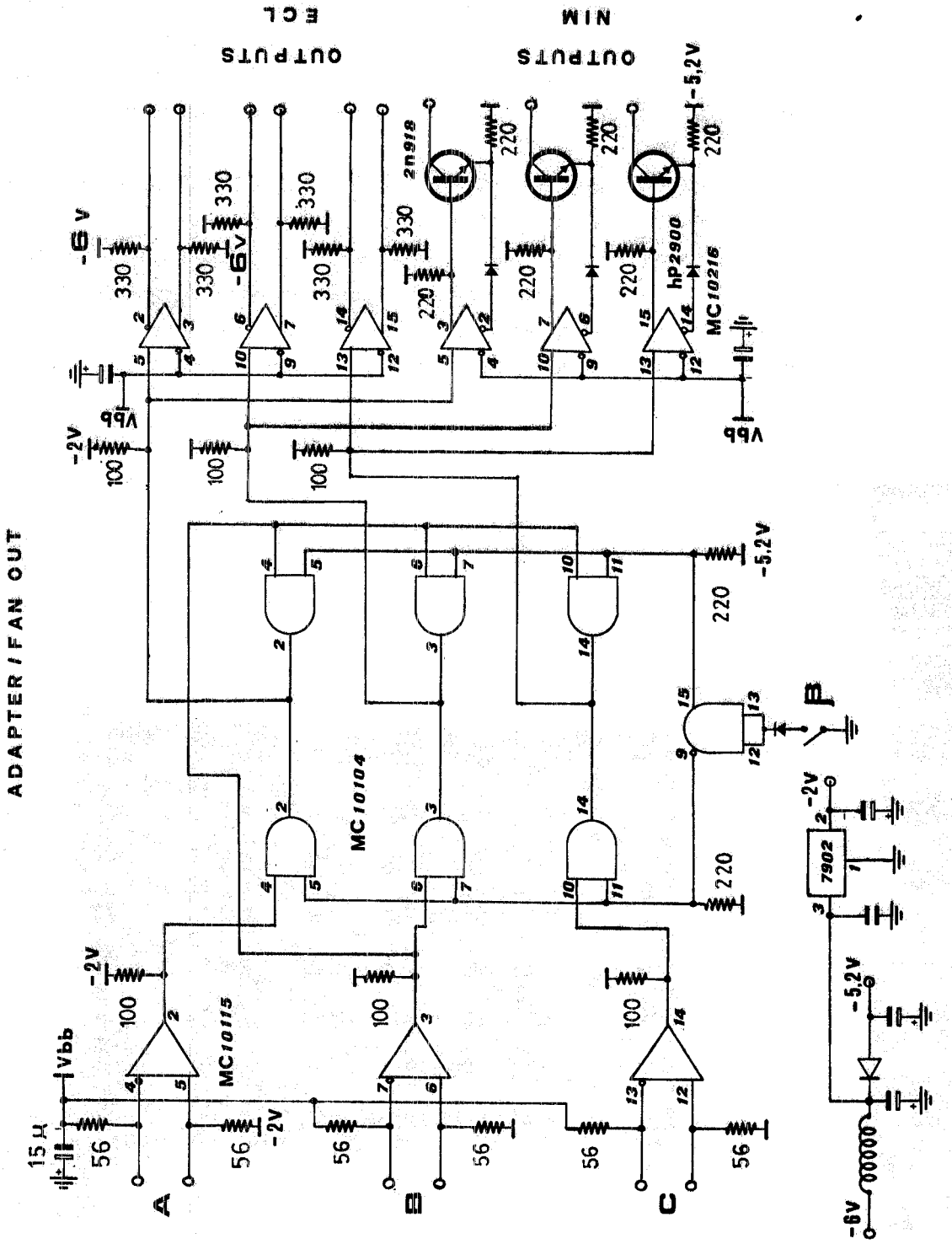

ADAPTER / FAN OUT
OUTPUTS
ECL
OUTPUTS
NIM
MC10115
MC10104
MC10216
2N918
HP2900
7902
-5,2V
-6V
-2V
Vbb
15 µ
A
B
C
P

FIG. 8

## 2. - AN ECL/NIM ADAPTER AND FAN-OUT (CPR 002). GENERAL DESCRIPTION.

This unit consists of eight independent sections. Each of them can work as a triple ECL/NIM adapter (Adapter mode) or a sestuple ECL FAN-OUT (FAN-OUT mode). The operating mode is selectable on each section by a front panel micro-switch (see Fig. 8). When the switch is open A, B and C inputs are independent (Adapter mode), when it is closed A and C inputs are inhibited (FAN-OUT mode).

A section working in Adapter mode is splitted in three independent ECL/NIM adapter channels. An ECL output timed within 0.5 ns with the NIM output is also available.

In the FAN-OUT working mode each section acts as a sestuple FAN-OUT with three ECL outputs and three NIM outputs with well-matched delay. The unit modularity is one NIM-SLOT.

On Fig. 8 we report the electrical diagram of one of the eight sections. The front view of the unit is shown in Fig. 9. The compactness of the internal construction can be appreciated on board picture (see Fig. 10).

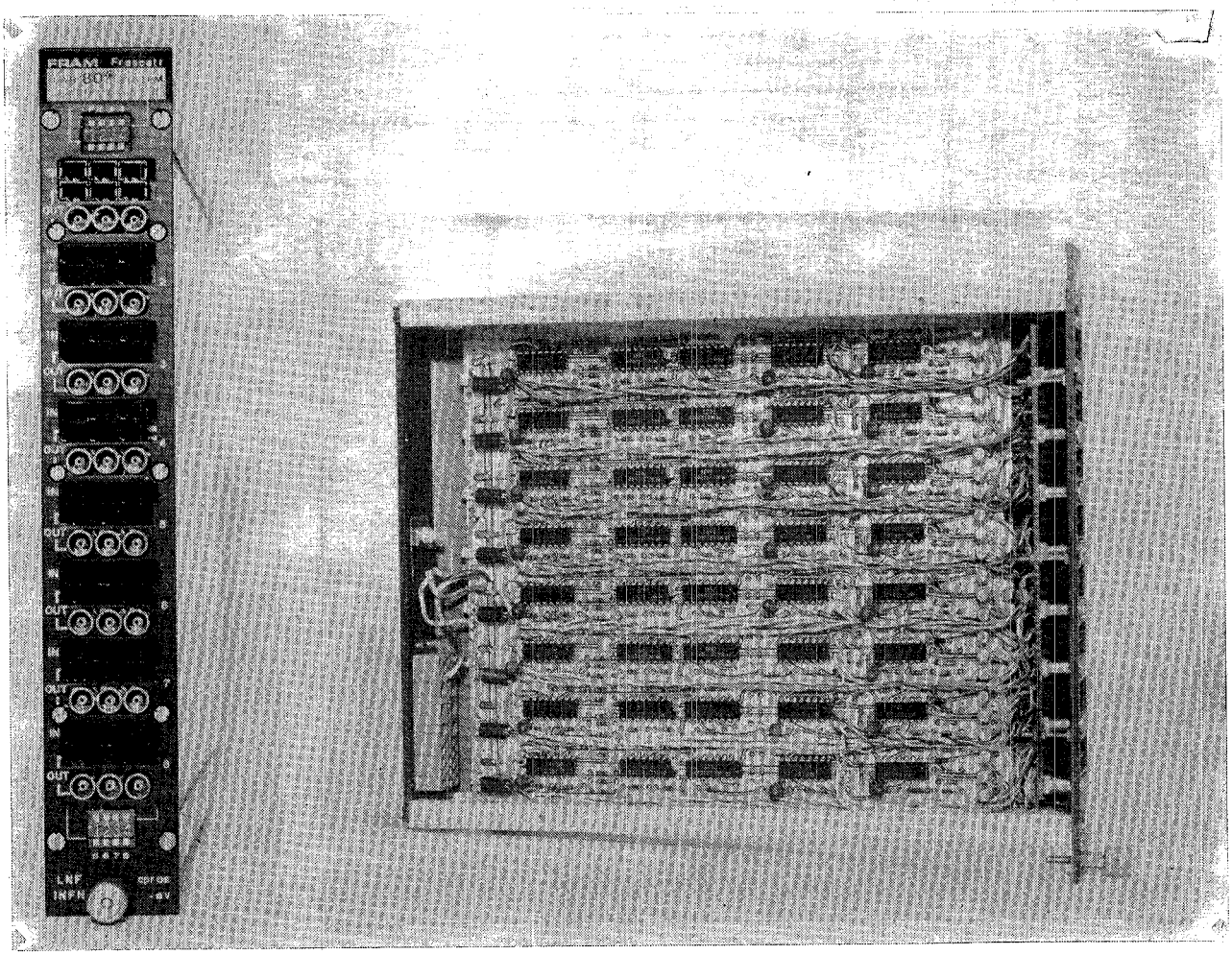


FIG. 9

FIG. 10

## SPECIFICATIONS (Each section)

| | | |
|---|---|---|
| WORKING MODE | : | FAN-OUT or Adapter modes are selectable by eight micro-switches |
| INPUTS | : | 24 ECL ($V_H$ = - 0.9 V, $V_L$ = - 1.7 V) on AMP 280370 2 connectors |
| OUTPUTS | : | 24 ECL and 24 NIM |
| POLARITY | : | non-inverting |
| RISE and FALL TIME | : | 2.5 ns, NIM and ECL |
| DELAY | : | input to ECL, output 11 ns<br>input to NIM, output 11.5 ns |
| MAX RATE | : | 100 MHz |
| POWER | : | - 6 V , 1.9 A |