BROOKHAVEN NATIONAL LABORATORY
Associated Universities, Inc.
Upton, L.I., N.Y.

SPEC. AGS-734
Job No. D09-OE365
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SPECIFICATION

FOR

DATACON SIGNAL STANDARDS

This specification consists of 9 pages.

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Introduction

The Datacon system consists of many units interconnected by a coaxial cable. This specification is to describe requirements and tests for new equipment design, and as a guide for upgrading and modifying existing equipment

The equipment described is separated into three categories:

1. The transmitted signal
2. The received signal
3. The coaxial interconnection system.

General Specifications

This specification is to supercede all previous specifications for new equipment design and construction

The transmitted and received signals consist of a group of rectangular pulses occurring as pairs of bipolar pulses with each pair consisting of a positive and a negative pulse.

Each group of pulses shall start with a frame pulse pair which is wider than all other pulse pairs. The other pulse pairs are called data pulses

Functions of the frame and data pulses are described in AGS Computer Note #31 "Datacon 2 Transmission Bit Definitions and Terminology" B. B Culwick, July 10, 1973.

The term datacon and datacon 2 are used interchangeably.

For the purpose of pulse specifications, pulses 2 through 35 are referred to as data pulses.

The parity pulse, pulse #35, is of a polarity such that the number of 'logical ones' in pulses #2 through 35 shall be an odd number.

The frame pulse is used to identify the beginning of a pulse train.

The key pulse is the first pulse pair which follows the frame pulse, and is always opposite in polarity to the frame pulse.

Transmitted Signals

The frame pulse shall be a bipolar pulse, each pulse of the pulse pair being 1 μsec in nominal width.

The data pulses shall be bipolar pulses, each pulse of the pulse being 0.5 μsec in nominal width.

The pulses may occur as a positive pulse followed by a negative pulse or as a negative followed by a positive.

A logical one is defined as a positive pulse followed by a negative pulse for pulses transmitted from a datacon central unit.

A logical one is defined as a negative pulse followed by a positive for pulse received at a datacon central unit.

The time between pulses in a pulse pair is nominally zero.

The time between pulse pairs is nominally 1.0 μsec.

The maximum time from the start of a frame pulse to the end of the parity pulse shall be 100 μsec

The minimum time between the end of a received pulse train and the start of a reply is 6 μsec. The maximum shall be 300 μsec. A pulse train shall consist of 35 pulse pairs.

Pulse #1 is the frame pulse.

Pulse #2 is the key pulse and is always of the opposite polarity as the frame pulse

Pulse #3 through 34 contains digital information

Pulse #35 is a parity check pulse.

Refer to Fig. 1 for time definitions

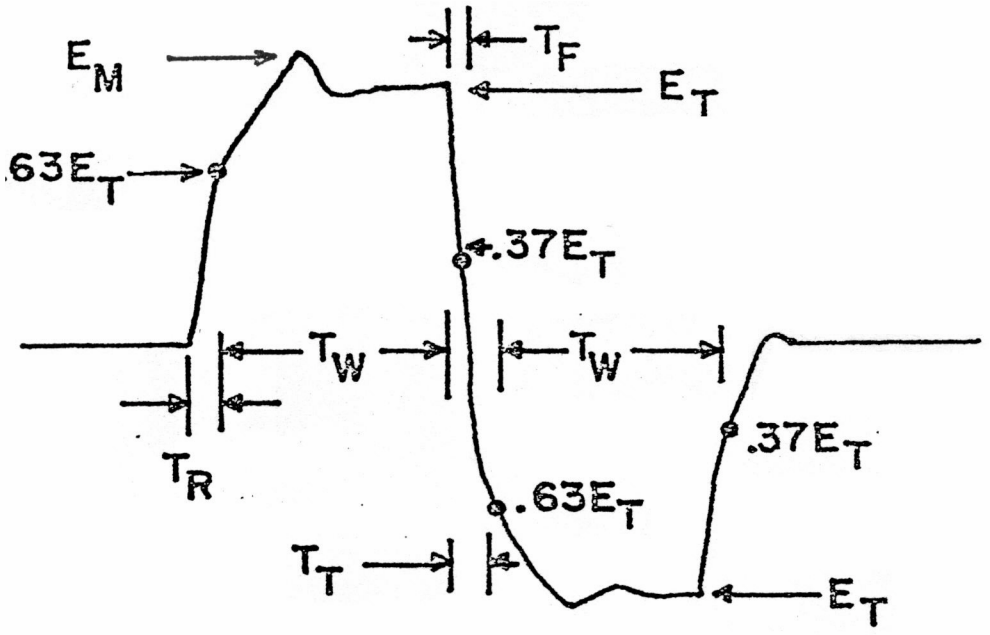
1. The pulse half width (Tw) shall be:

Frame pulse $1.00 < Tw < 1.2$ μsec

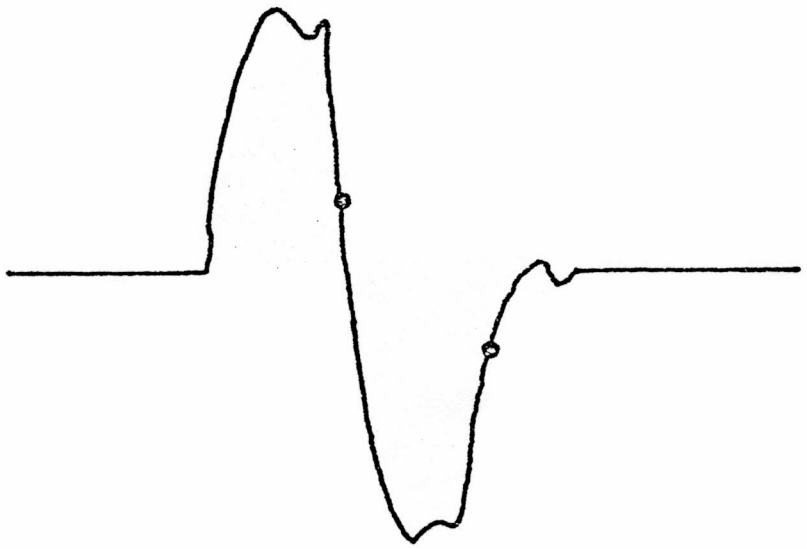
Data pulse $0.35 \leq Tw < 0.5$ μsec

ULSE CHARACTERISTICS

FRAME PULSE



DATA PULSE



PULSE TRAIN

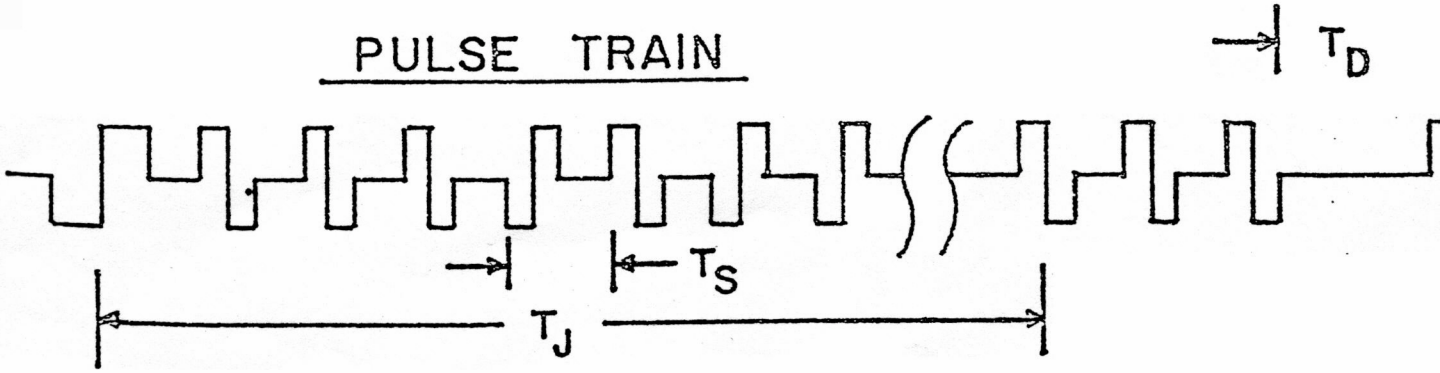


FIG. 1

2. The transition time (Tt) for both frame and data pulses shall be less than 0.1 μsec.

3. The rise times (Tr) and fall times (Tf) shall be less than 0.1 μsec for both frame and data pulses.

4. The maximum overshoot voltage (Em) shall not be greater than 1.5 (Et).

5. The minimum delay between pulse trains (Td) shall be 6.0 μsec.

6. The transmitted voltage (Et) is defined as the average value of the voltage during the last half of the pulse.

7. Rise and fall time are specified as a percentage of (Et).

8. Rise time (Tr) and fall time (Tf) are measured at 63% of Et.

9. Pulse baseline shift shall limit the average voltage (E_A) such that

$$E_A = \frac{\int_{T=0}^{T=Te} E\, dT}{Te} < .1\ Et$$

where Te is the time for a complete pulse train.

10. For all resistive loads (Re) on a transmitter between

$30\Omega < Re < \infty$

the transmitted voltage Et shall be

10 volts < Et < 21 volts.

11. A transmitter shall be capable of driving a short circuit load at full duty cycle without component failure.

12. Full duty cycle is one pulse train every 200 μsec.

13. The transmitter shall tolerate a 40 volt received signal without component failure.

14. The pulse spacing (Ts) shall be such that the minimum time between the start of one data pulse and the next shall be 1.8 μsec. Between the start of the frame pulse and the start of the first data pulse the minimum time shall be 3.2 μsec.

Received Signal

The minimum impedance looking into a datacon unit from the line shall be 3000 ohms resistive in parallel with 50 pf capacitance and 20 millihenry inductance for a signal level of 10 volt pulses of either polarity.

nominal signal amplitude shall be ± 10 volts

receivers will tolerate, without burnout, an Er level of ± 35 volts.

All receivers will operate with an Er of 20 volts

Er nominal is 10 V.

voltages Et at which a transition to a logical one state occurs shall be more than 4.0 volts and less than 6.0 volts.

The voltage Eh at which a transition to a logical zero state occurs shall be more than 3.5 volts and less than 5.5 volts.

Et shall be greater than Eh by a least 0.5 volts.

For all frequencies between 60 Hz and 2 MHz the common mode voltage rejection shall be greater than 40 DB as measured from the input connector to the output of the transformer.

The transformer shall be insulated for 115 Vac 60 Hz common mode voltages.

The Coaxial Interconnection System

1. The units are connected on a coaxial distribution system at any point along the cable as necessary.
2. The cable may consist on one long run tapped at each unit or as a node branching system or as any combination of the two.
3. At each node in the system suitable amplifiers, repeaters, and impedance transformations shall be included to prevent reflection and attenuation of the pulses.
4. The cable(s) shall be terminated at each end with a resistive termination which matches the impedance of the cable.
5. The cable impedance is not specified, but shall be 50 ohms or larger.
6. The values 50, 75 and 93 ohms are preferred.
7. Mixed impedances on a system may be used if suitable matching and attenuation specifications are not violated.
8. The cable transmission system, including any amplifiers, repeaters or branch connections, shall not significantly degrade the systems operating speed.
9. The cable outer conductor shall be grounded only at the datacon central unit.
10. No unit connected to the system shall present a resistance to ground from either inner or outer conductor less than 3000 Ω, or a capacitance of greater than 50 pf.
11. The number and quality of units attached to any one cable shall not cause reflected pulses to exceed 20% of the transmitted signal amplitude when measured anywhere on the line.
12. As a design criterion the maximum number of units on a single distribution system shall be 33.

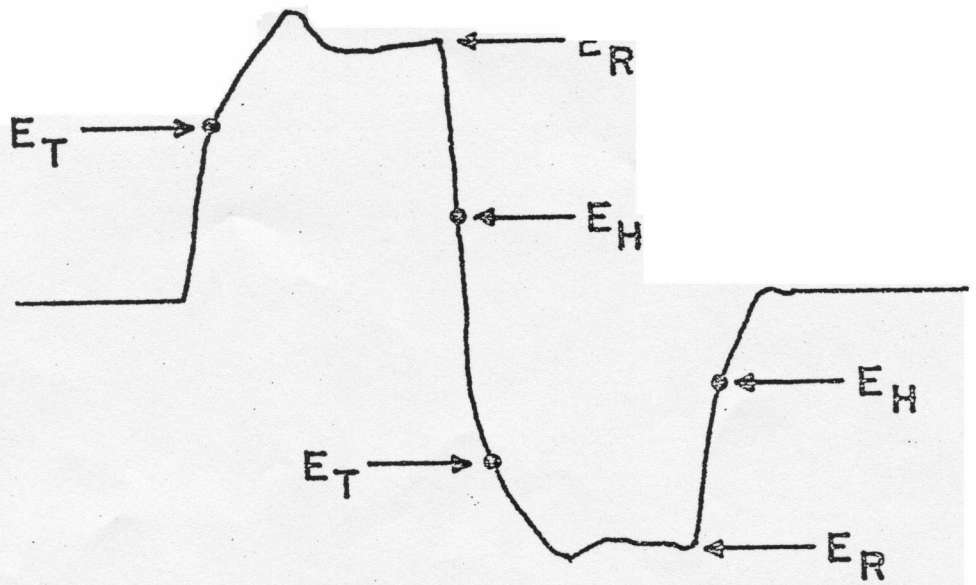
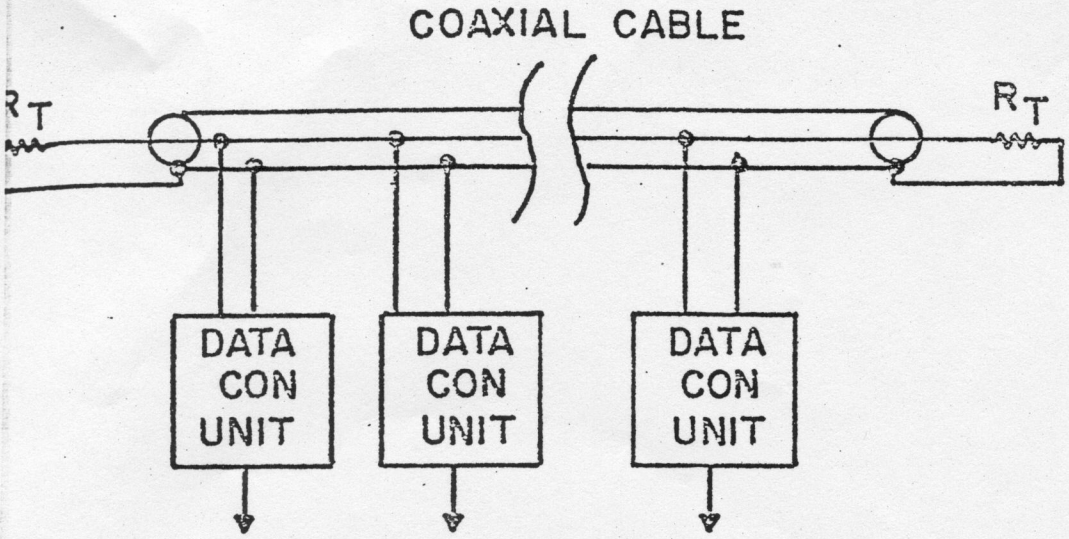


FIG. 2

SYSTEM DIAGRAM #1



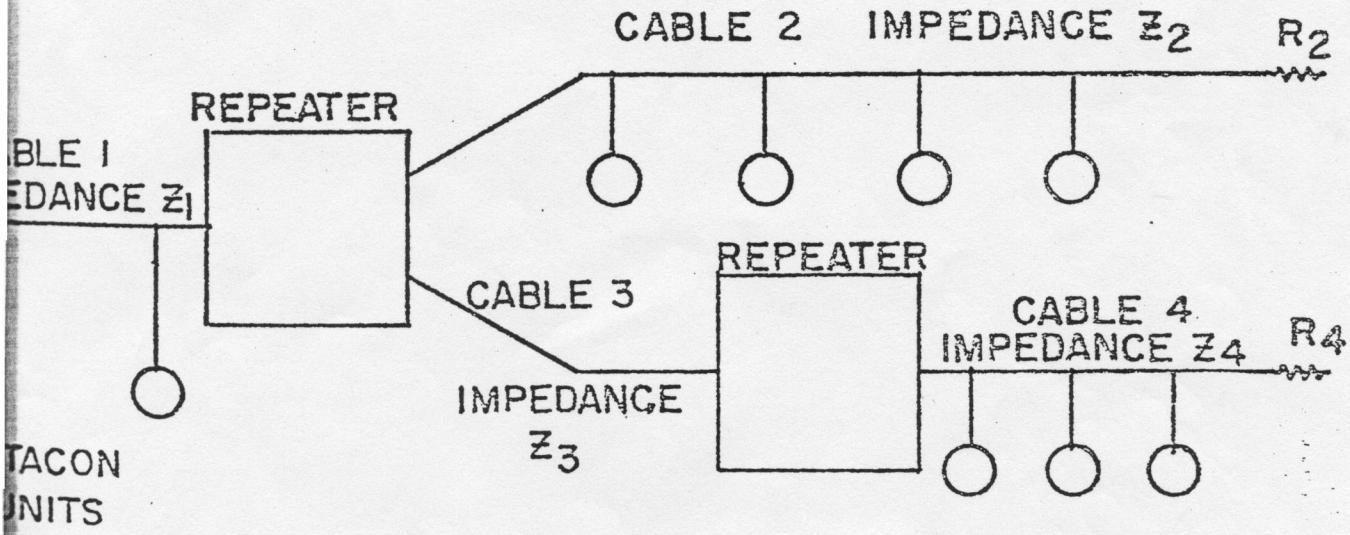


FIG. 3